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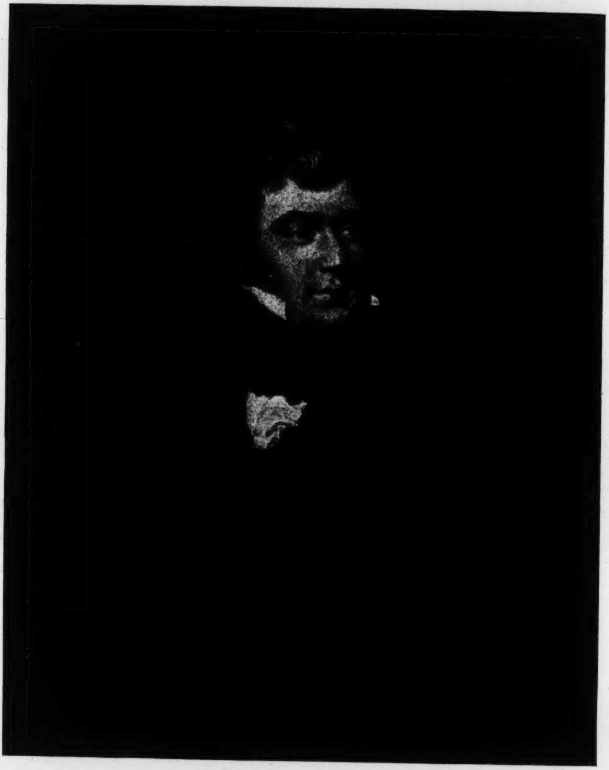

JAMES BLUNDELL
[1790-1878]

[From Fabricius d'Acquapendente: Opere Chirurgiche. Padova, 1684.]

ANNALS OF MEDICAL HISTORY

NEW SERIES, VOLUME IV SEPTEMBER, 1932 NUMBER 5

HISTORY OF BLOOD TRANSFUSION*

By LEO M. ZIMMERMAN, M.D., AND KATHARINE M. HOWELL, M.D.
CHICAGO

THE ancients believed, as many do today, that the blood not only carried the vital force of the body, but that it was the seat of the soul as well. Debilitating diseases and the infirmities of advancing age were consequently thought to be due to loss or exhaustion of this essential force, while insanity was a sickness of the soul. To substitute for these wasted and perverted bloods, blood from healthy young bodies seemed, naturally, a most direct cure for these ills. It is not surprising, therefore, that we find ever-recurring attempts to cure disease by blood transfusion. The dangers associated with the procedure, which we recognize today, in the light of our knowledge of infection, immunology and the phenomena of blood coagulation, explain the failures and disasters that early attempts at blood transfusion encountered. This conflict between the desire to transfuse and the inherent risks involved, largely accounts for the alternate waves of enthusiasm and neglect that the operation of transfusion has experienced, although personal feelings, politics and religion were all involved at one time or another in creating one of the most interesting chapters in medical history.

The use of blood as a therapeutic agent is as old as medicine itself. We are told of blood baths used by ancient Egyptian princes for resuscitation and recuperation. Pliny describes the drinking of the flowing blood of gladiators in the arena "as if out of living cups" as a cure for epilepsy. This form of treatment was advised by many of the ancient writers, including Galen. Celsus deplores the custom of the people who rushed into the arena to drink the blood fresh flowing from the jugular veins of the dying victims. At a later period, Bartholin (1673) describes numerous instances of the use of blood as a remedy. "He speaks of the use of the blood of cats, doves, turtles and other animals in the treatment of epilepsy and quaintly tells of a girl at Breslau, an epileptic, who, after taking cat's blood, became endowed with the characteristics of a cat. Not content with climbing on the roofs of houses and imitating the manners of cats in voice, jumping, scratching and yowling, she would sit for hours gazing into a hole in the floor!"[1]

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* From the Nelson Morris Memorial Institute for Medical Research of the Michael Reese Hospital, Chicago, Ill., aided by the Otto Baer Fund.

The discovery of transfusion is frequently attributed to the sorceress Medea, wife of Jason. According to Ovid, the festivities attending the return of the Argonauts from Colchis were marred by the senescence and debility of Aeson. Jason implored Medea to use her magic powers to restore youth and strength to his aged father. This she promised, and gathering herbs throughout the world, brewed a mixture so potent that a withered olive branch with which she stirred it at once bore leaves and fruit. Then, according to the poet;

> Medea unsheathed her knife and cut the old man's throat, then letting the old blood all run out, she filled his veins with her brew. When Aeson had drunk this in part through his lips and part through the wound, his beard and hair lost their hoary grey and quickly became black again; went the pallor and the look of neglect, the deep wrinkles were filled out with new flesh, his limbs had the strength of youth. Aeson was filled with wonder, and remembered that this was he forty years ago.

Aside from the purely mythological character of this operation, it is obviously incorrect to consider it a blood transfusion. Nor could the ancients have been expected even to visualize the possibilities of actual transfusion in view of the then prevailing conceptions of the circulation. Aristotle taught that the blood was prepared within the chambers of the heart, whence it flowed to nourish all parts of the body, but never to return to the heart. From the period of the Alexandrian school, 300 B.C., to the time of Galen, the idea prevailed that the arteries carried air from the lungs to the tissues. This incorrect hypothesis was disproved by Galen, who substituted for it the belief that the blood was generated in the liver, and moved back and forth in the vessels until consumed, its supply being constantly replenished by the liver. The teachings of Galen held undisputed sway for 1400 years, until the period of the Renaissance.

The first transfusion of blood in the modern sense is reputed to have been done at Rome in about 1490. Pope Innocent VIII lay dying from that "terrible disease, extreme old age." A Jewish physician attempted to rescue the Pontiff by transfusing into his veins the blood from three small boys, who were each to receive a ducat as reward. The testimony as to what actually transpired is conflicting. According to one version, the blood was used to prepare a draught for the illustrious patient. There is no assurance that he received either the transfusion or the drink. All seem agreed, however, that the three boys died, that the death of the Pope was not stayed, and that the physician fled as quickly as possible after the failure of the experiment.

The Renaissance, in directing all thought back to the classical era, brought a revival of interest in the blood as the seat and source of all living power. Enlarging upon the theories of Paracelsus, Helmont taught that this vital force was engendered in the heart and that exhaustion, senility and loss of reason were due to lack of this essential principle. Spirited, youthful blood was the "natural balsam of life," and its therapeutic use was indeed rational. As an expression of this, we find mention of the possibilities of transfusion in certain of the writings of the 15th and early 16th centuries. Marsilius Ficinus, the renowned Platonist (1489), advised the drinking of healthy young blood to dispel the weakness and infirmities of old age, as "witches and monsters" were reputed to do. Hieronymus Cardanus (1505–1576) and Magnus Pegelius (1593) mention the possibilities of transferring blood directly from the vessels of one person to those of another. Andreas Libavius (1615) first definitely advocated blood transfusion and described in detail a technique which was very similar to that used until very recently. However, the extravagance of his claims and the ironic tone of his script imply that he held the operation in contempt as quackery and charlatanry. Thirteen years later, Professor Johannes Colle of Padua seriously suggested the transfusion of blood.

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[1] Quoted from Holmes à Court.

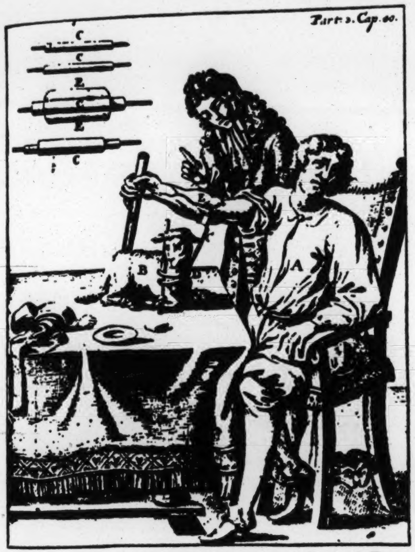

FIG. 1. SEVENTEENTH CENTURY LAMB BLOOD TRANSFUSION. MATTHAEUS GOTTFRIED PURMANN, 1684.

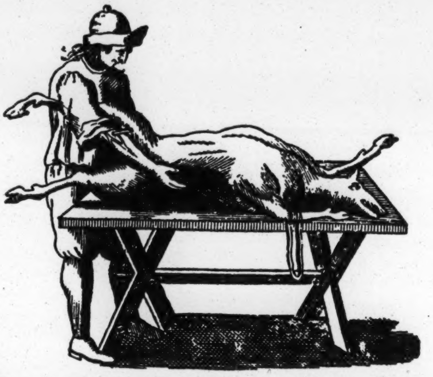

FIG. 2. EARLY CONCEPTION OF ANIMAL BLOOD TRANSFUSION. HEISTER, 1724.

The actual history of blood transfusion necessarily begins with the discovery of the circulation, in 1616. Electrified by Harvey's immortal contribution, investigators throughout the world began to experiment energetically with the infusion of various substances into the blood stream, and to speculate upon the feasibility of transferring the blood from the arteries of one individual into the veins of another. It is, in all probability, because of the direct stimulation of Harvey's lectures that the first coordinated and scientific studies of infusion and transfusion were made in England. In 1656, the astronomer and architect, Christopher Wren, injected medicaments into the veins of dogs, by means of bladders fastened to quills. He told his friends, Wilkins, Robert Boyle, and others, of his experiments, and they pursued them further. In the following year, the first human infusion was done in London, a convicted malefactor having served as experimental subject.

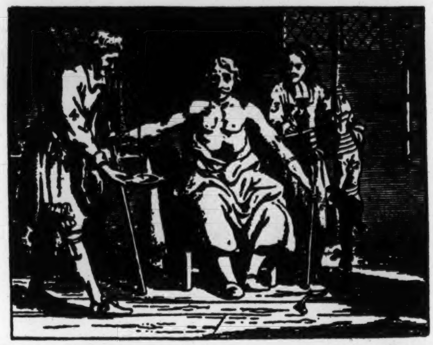

Fig. 3. Contemporary Illustration of Early Lamb Blood Transfusion. Lamsweerde, 1684.

The first successful transfusion of blood from one animal to another was done in 1665 in Oxford, and later in London, by Richard Lower, anatomist and physician, who performed "this experiment, hitherto looked upon to be of an almost unsurmountable difficulty" by uniting the artery of one dog with the vein of another by means of quills or silver tubes. The experiments were repeated before the Royal Society, and a series of further trials were outlined by that body. Reports of these achievements spread to other countries; and in the following year, the first human transfusion was done in Paris, by the Montpellier philosopher and mathematician, Jean Baptiste Denis. The first patient was a youth of fifteen or sixteen years who was suffering from an obscure fever, in the course of which he had been subjected to some twenty venesections, until he lay in a state of apathy and exhaustion. Following the successful administration of 9 ounces of blood from the carotid artery of a lamb, astonishing improvement resulted.

The second transfusion performed by Denis and his assistant Emmeris was purely in the nature of an experiment. The subject, a perfectly healthy man, consented to the experiment for a financial consideration. Following a venesection of 10 ounces, approximately twice that amount of blood was permitted to flow into his vein from the femoral artery of a lamb. The operation was completed with smoothness and dispatch, the patient felt no untoward symptoms other than a feeling of warmth in his arm, and instead of going home and to bed as instructed, he repaired at once to a public house with his cronies to dispose of his easily earned money. The report of these successful transfusions spread widely, Denis became renowned as a transfusor, and a storm of opposition, hatred and jealousy arose, in which religion, metaphysics and personal animosity were invoked in a bitter battle of polemics and defamation. A third transfusion on a moribund patient was effective only in delaying death a number of hours, and the fateful fourth case brought a cataclysmic upheaval that buried Denis and his favorite operation for a century and a half. The patient, a lunatic, had been twice transfused by Denis, apparently with temporary alleviation of his mania. Following the second transfusion "his arm became hot, the pulse rose, sweat burst out over his forehead, he complained of pain in the kidneys and was sick at the stomach. The next day the urine was very dark, in fact black." A third transfusion, undertaken at the request of the patient's wife, resulted in death. Denis' enemies hastened to make capital of this misfortune. They conspired with the widow to bring action against the transfusor, charging him with murder. Counter charges that the patient had

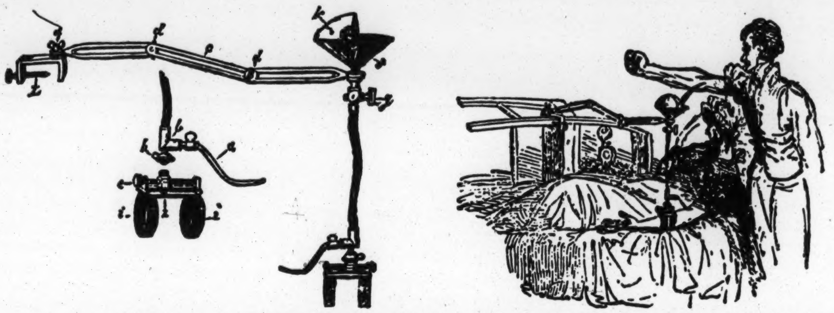

FIG. 4. BLUNDELL'S "GRAVITATOR." NINETEENTH CENTURY HUMAN BLOOD TRANSFUSION BY MEANS OF GRAVITATOR. BLUNDELL, 1828.

been poisoned by his wife were introduced; and a prolonged legal battle ensued, in which Denis was eventually exonerated of the murder charge, but further transfusions were prohibited, except by the approbation of the Faculty of Medicine of Paris. Inasmuch as the chiefs of the Faculty were the leaders of the opposition to transfusion, this decree was, in effect, a prohibition of further transfusion. Some ten years later (1678), experiments with transfusion upon human beings were specifically prohibited by an edict of Parliament, thus closing this chapter in the history of blood transfusion so far, at least, as France was concerned.

In the meantime, reports of Denis' transfusions having reached other countries, timid attempts were made at transferring blood from animals into human beings. On November 23, 1667, Lower and King in England performed the first human transfusion using sheep's blood, which was well tolerated.[2] A second transfusion on the same subject several weeks later also terminated successfully. In Germany, Balthasar Kaufmann and Gottfried Purmann cured a case of leprosy by repeated transfusions of lamb's blood, but failed to effect a cure in two scorbutic soldiers and a fisherman suffering from a "devouring eruption." Riva and Manfredi, in Italy, transfused two human beings with sheep's blood, but the magistrates in Rome were so impressed with the action of the Parisian Court in the case of Denis, that they also forbade transfusion from animal to man. It has been said that a special edict of the Pope (1675) brought further investigation of transfusional surgery to a standstill in almost all parts of Europe, but evidence of this is lacking.

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[2] Mention of these experiments is found in the diary of Samuel Pepys. "November 14, 1666 . . . Dr. Croone told me, that, at the meeting at Gresham College tonight . . . there was a pretty experiment of the blood of one dog let out, till he died, into the body of another on one side, while all his own ran out on the other side. The first died upon the place, and the other very well, and likely to do well. This did give occasion to many pretty wishes, as of the blood of a Quaker to be let into an Archbishop, and such like; but, as Dr. Croone says, may, if it takes, be of mighty use to man's health, for the amending of bad blood by borrowing from a better body.

"November 21, 1667. With Creed to a tavern, where Dean Wilkins and others; and good discourse; amongst the rest, of a man that is a little frantic . . . that the College have hired for 20 s. to have some of the blood of a sheep let into his body; and it is to be done on Saturday next. They propose to let in about twelve ounces; which, they compute is what will be let in in a minute's time by a watch.

"November 30, 1667. I was pleased to see the person who had his blood taken out. He speaks well, and did thus give the Society a relation thereof in Latin, saying that he finds himself better since, and as a new man, but he is cracked a little in his head, though he speaks very reasonably, and very well. He had but 20 s. for suffering it, and is to have the same again tried upon him; the first sound man that ever had it tried upon in England, but one we hear of in France."

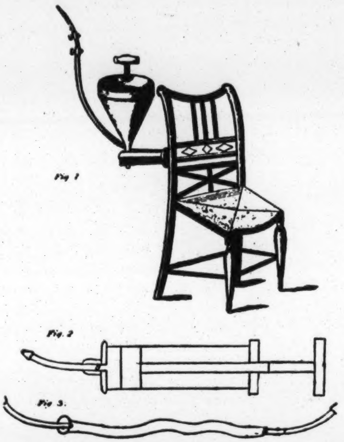


FIG. 5. BLUNDELL'S "IMPELLOR." BELOW, CANNULA AND SYRINGE, 1825.

It is interesting to note that of the cases selected for transfusions during this first period there were no patients in acute anemia. On the contrary, the operation was undertaken to cure such conditions as advanced lung and bowel disease, to restore youth to the senile, or to bring the insane to reason. In fact, it was the possible mental effects of the transfused blood which seems to have appealed most strongly to the imagination and interest of the early investigators. During the earliest animal transfusions, Robert Boyle asked whether the recipient dog would still recognize his master after receiving the strange blood, and speculation was rife as to whether dogs transfused with sheep's blood would grow wool, hoofs and horns, or whether small dogs would change their stature if transfused with blood from large animals. Elsholz (1677) proposed that the temperament of the melancholic be corrected by transfusing him with the blood of a sanguine person, and that of the phlegmatic be corrected with the blood of a choleric; and he even suggested that marital discord be settled by reciprocal transfusions of the husband and wife.

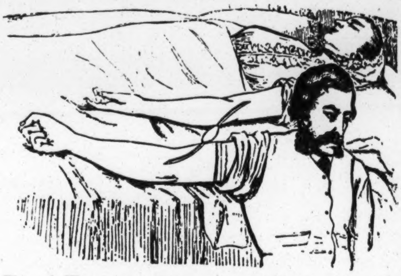


FIG. 6. TRANSFUSION WITH THE AVELING APPARATUS. AVELING, 1863.

With such naive and irrational selection of cases for transfusion, cures were necessarily infrequent, reactions were often severe, and the phenomena attendant upon the injection of incompatible bloods were beginning to be recognized. In view of the complete ignorance of asepsis, of immunology and of the processes of coagulation, it is indeed fortunate that the pressure of administrative and ecclesiastical disfavor brought about a cessation of further attempts at human transfusion. While the motives and methods of the opponents to transfusion are not above criticism, their effects were of service in postponing further experimentation until the advance of scientific knowledge made conquest of some of the dangers and difficulties possible.

For a period of one hundred and fifty years, the operation of blood transfusion fell into complete desuetude, and, except for an occasional case report, was relegated to a place among the medical curiosities. Various writers lamented the fact, but did nothing constructive toward bringing the operation back into favor. Dr. Harwood (1792) performed several animal transfusions at Cambridge. In the same year, in Suffolk, Dr. Russel is said to have cured a boy of hydrophobia by transfusion with lamb's blood. In 1796, Erasmus Darwin, grandfather of the illustrious Charles, advocated transfusion in carcinoma of the esophagus and other conditions in which nutrition was inadequate. He recommended for the purpose goose-quills connected together by a piece of chicken gut. There is no record, however, that he actually performed the operation. Paul Scheel of Copenhagen was so convinced of the value of the procedure that he published a monograph in 1802, containing a most careful and laborious review of the entire literature on infusion and transfusion compiled from original sources in the various countries in which it had appeared.

Great strides were being made, in the meantime, in the medical sciences. Anatomy and histology attained almost their full growth, while physiology and pathology were developing rapidly. The dangers of embolism and of the entrance of air into the blood vessels were recognized, and the phenomena of blood coagulation were being studied. Prof. Rosa of Modena experimented with blood transfusion in 1783, under the direction of Scarpa. He found that the blood vessels were able to adapt themselves to increased blood volumes, so that the preliminary venesections which had hitherto been considered indispensable were superfluous. Prevost and Dumas (1821) found that exsanguinated animals could be revived by the transfusion of blood, while the injection of serum or of water heated to 38°c. was without effect. Blood from animals of another species was less effective than was homologous blood, and though life was restored, the animals succumbed within six days. Defibrinated blood and blood which had been standing were found to be as efficacious as fresh, whole bloods. From their experiments, Prevost and Dumas concluded that the operation was "unfortunately too celebrated, that it had been abused in an ignorant and barbarous century, and that it deserved to be abandoned" until the effective principles in the blood were better understood.

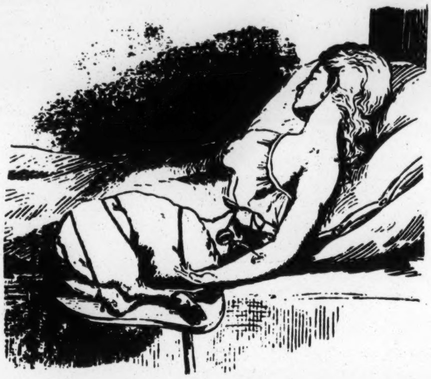


FIG. 7. DIRECT SHEEP'S BLOOD TRANSFUSION. OSCAR HASSE, 1874.

The re-discovery of blood transfusion in the 19th century was again the contribution of an Englishman, the London physiologist and obstetrician, James Blundell (1790–1877). Appalled by his helplessness in the face of overwhelming puerperal hemorrhage, his mind turned toward the direct expedient of returning blood to the exsanguinated organism. "If

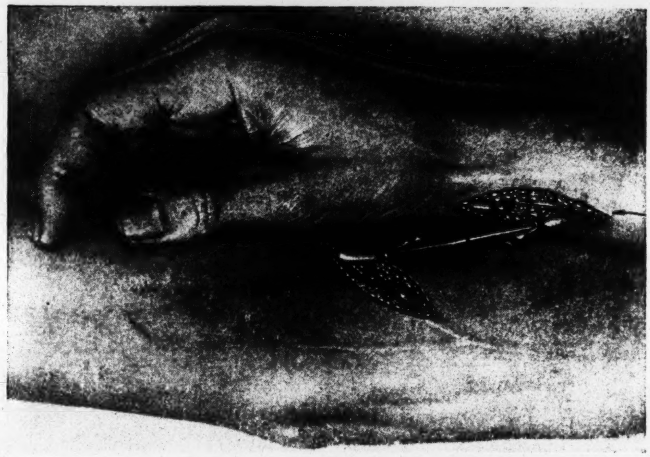


FIG. 8. DIRECT ARTERIOVENOUS TRANSFUSION. BERNHEIM, 1917.

I have any claim, however small," he wrote, in 1834, "to rank among supporters of transfusion, it lies entirely in this; that undeterred by clamor or scepticism, I have made it my endeavor, again, to bring the operation into notice." Subjecting the question of blood transfusion to careful scientific experimentation, he found that death from hemorrhage could be prevented by the transfusion of blood from animals of the same species, even after all signs of life had disappeared. Blood from animals of another species he found unsuitable, since the temporary resuscitation it effected was followed by death after several days. For human transfusion he declared "human blood, of the kinds used, alone fit for the operation." Direct transfusion required an operation upon the artery of the donor, which in those days was a formidable procedure. Blundell therefore studied the effect of passing blood through a syringe. He found that blood lost none of its life-giving properties by such handling, that venous blood was as satisfactory as arterial, and that it was not only unnecessary, but undesirable to restore as much blood as had been lost. To obviate the necessity of cannulating the vein of the donor, he devised a modification of the simple syringe which had a three-way valve very similar to those in use today. This, and his later instruments, the "impellor" and the "gravitator" were the first of the long series of instruments invented for indirect transfusion of blood.

"With a mind rationally prepared to the best of my power, by previous reflection and experiment" Blundell applied the results of his studies to the human body, and to him belongs the credit of performing the first transfusions with human blood. His first four attempts were desperate resorts in dying patients, and all failed. But convinced by his experiments that he must succeed, he persevered, and his efforts were rewarded by the resuscitation of several women when death from postpartum hemorrhage seemed certain. He performed the operation eleven times,

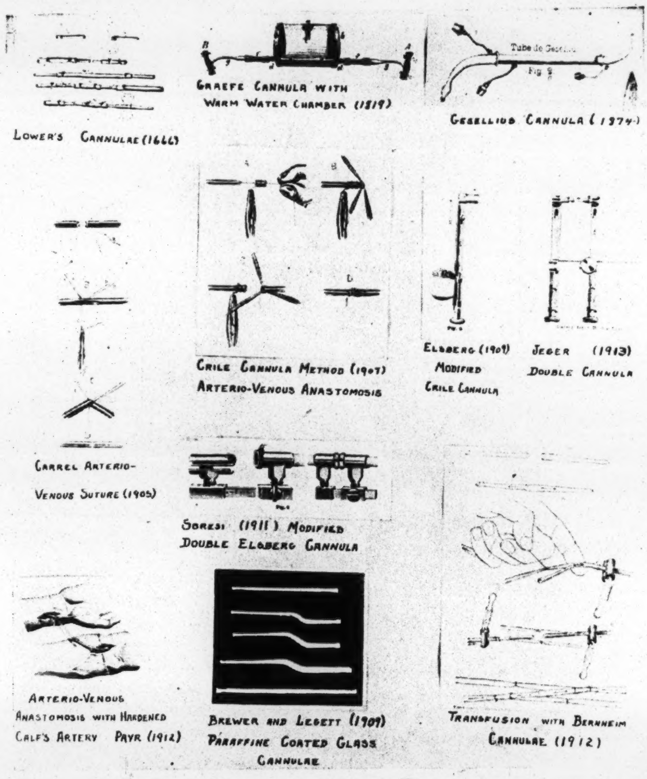

LOWER'S CANNULAE (1666)
GRAEFE CANNULA WITH WARM WATER CHAMBER (1819)
Tube de Gesellius
Fig 9
GESELLIUS CANNULA (1874)
CARREL ARTERIO-VENOUS SUTURE (1905)
CRILE CANNULA METHOD (1907) ARTERIO-VENOUS ANASTOMOSIS
ELSBERG (1909) MODIFIED CRILE CANNULA
JEGER (1913) DOUBLE CANNULA
SORESI (1911) MODIFIED DOUBLE ELSBERG CANNULA
ARTERIO-VENOUS ANASTOMOSIS WITH HARDENED CALF'S ARTERY PAYR (1912)
BREWER AND LEGETT (1909) PARAFFINE COATED GLASS CANNULAE
TRANSFUSION WITH BERNHEIM CANNULAE (1912)

FIG. 9. METHODS FOR DIRECT TRANSFUSION.

a number greater than that of any of his predecessors; and he succeeded not only in bringing the operation of transfusion back into notice, but also in placing it upon a firm clinical basis, with rational indications and a scientific background; moreover, he introduced methods which find their expression in the more common techniques employed today.

Following the example of Blundell, a certain number of other surgeons and obstetricians performed transfusions, chiefly in England. It was, however, an operation to be performed only as a last resort. Phlebitis, both in the recipient and donor, had constantly to be feared. Reactions were frequent, and sometimes death occurred, even when human blood was used. Technical difficulties, particularly those due to coagulation of the blood, were many. Progress was being made, however, toward the control of these last named difficulties. Prevost and Dumas, as mentioned, had experimented with the transfusion of defibrinated blood, and with bloods rendered incoagulable by the addition of caustic soda. These experiments were elaborated by Dieffenbach (1826), who found that fibrin suspended in water or serum had no power to restore life after hemorrhage. Bischoff, in 1835, went further, to show that whole blood injected into animals of another species was toxic, but defibrinated blood of the same type, injected into those animals, was well borne, and that it was effective in reviving the animal after exhaustive bleeding. He concluded that the fibrin was the toxic agent and advised the transfusion of only defibrinated bloods. The first actual transfusion with defibrinated blood was done in 1847, by Larsen (at the suggestion of Panum).

While the application of transfusion in various diseases was being held *sub judice*, its indication in acute hemorrhages, particularly those following childbirth, had been established, and we find its use during the half century following the publication of Blundell's work largely limited to cases of this type. In 1859, Edward Martin collected 57 cases of transfusion for postpartum bleeding, in 45 of which recovery was reported. None of the fatalities, however, was attributed to the transfusions. Belina-Swiontkowski, ten years later, collected 155 cases of blood transfusion.

Significant studies were being made about this time by Magendie and Brown-Sequard, by Jakob-Mueller, by Panum, Landois and Mueller, on the physiology of the blood, on the cause of febrile reactions following transfusion and on the fate of heterologous blood corpuscles. Creite (1869)

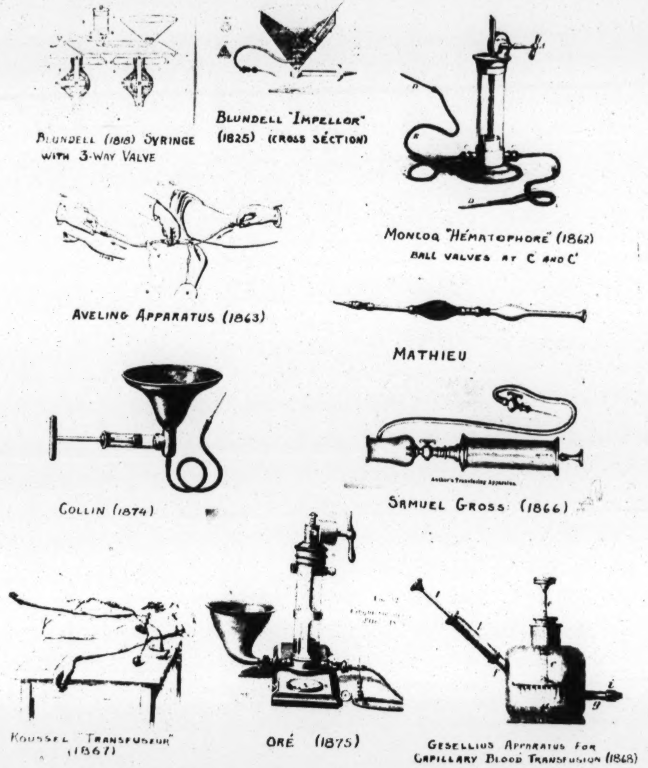
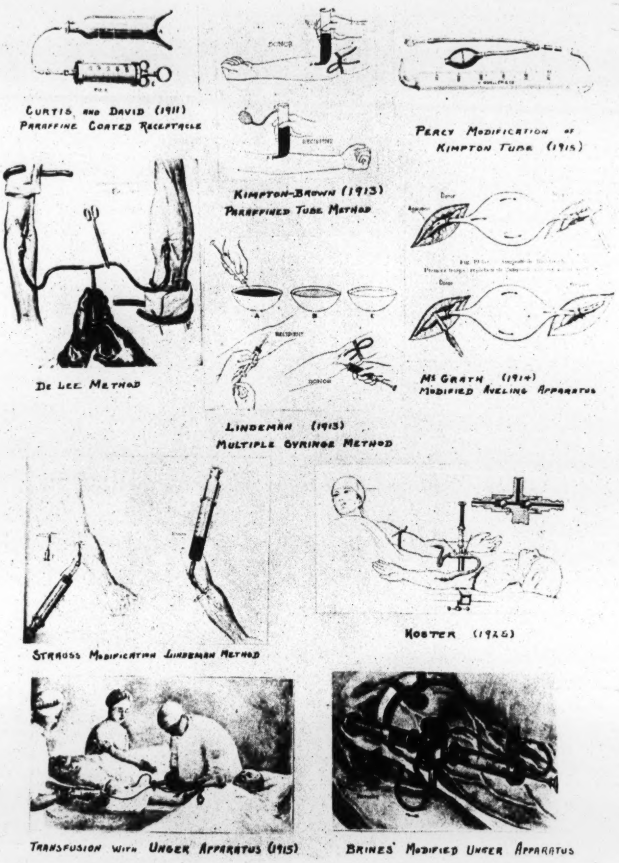

Blundell (1818) Syringe with 3-Way Valve
Blundell "Impellor" (1825) (cross section)
Moncoq "Hématophore" (1862) Ball valves at C and C'
Aveling Apparatus (1863)
Mathieu
Collin (1874)
Samuel Gross (1866)
Roussel "Transfuseur" (1867)
Oré (1875)
Gesellius Apparatus for Capillary Blood Transfusion (1868)

FIG. 10. METHODS FOR INDIRECT TRANSFUSION PRIOR TO 1900.

described the clumping of human red blood corpuscles, when placed in the sera of cats, dogs, sheep or birds. Landois (1875) elaborated these experiments and found that sera of one species agglutinated and dissolved the corpuscles of other species. He explained the hemaglobinuria following heterologous transfusion upon this basis. These investigations led more and more strongly to the conviction that the transfusion of foreign blood was dangerous and that only human blood should be used. Clinically, the field of indications was extended in 1864 to the use of transfusion in carbon-monoxide poisoning, and later, with less success, in poisonings of other types, sepsis and leucemia. Braxton-Hicks, in 1868, treated blood with phosphate of soda to retard coagulation during transfusion. Innumerable instruments were devised, many of them bizarre and complicated, to facilitate the transfusion of both whole and defibrinated bloods.[3]



CURTIS AND DAVID (1911) PARAFFINE COATED RECEPTACLE

KIMPTON-BROWN (1913) PARAFFINED TUBE METHOD

PERCY MODIFICATION OF KIMPTON TUBE (1915)

DE LEE METHOD

MCGRATH (1914) MODIFIED AVELING APPARATUS

LINDEMAN (1913) MULTIPLE SYRINGE METHOD

STRAUSS MODIFICATION LINDEMAN METHOD

KOSTER (1926)

TRANSFUSION WITH UNGER APPARATUS (1915)

BRINES' MODIFIED UNGER APPARATUS

FIG. 11. INDIRECT TRANSFUSION METHODS SINCE 1900.

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[3] Thomas Smith (1873) reported a case of transfusion, without effect, into a dying patient, in which the apparatus employed consisted of "a wire egg-beater, a hair sieve,

Toward the end of the third quarter of the 19th century, the growing interest in blood transfusion culminated in a wave of exaggerated enthusiasm, in which the procedure was heralded as ushering in "a new era in medicine." With the increased popularity came a curious departure from principles which had become firmly established during the years. Instead of limiting the operation to cases of anemia or acute hemorrhage, it was applied to a host of vague infectious and debilitating diseases, including phthisis, as well as to "the burnt, the uremic, the syphilitic and the mad." In spite of the frequently demonstrated dangers and disadvantages of heterologous transfusions, animal blood was again widely used. The Russian physician, Gesellius, in his book, "The Transfusion of Blood" (1873), contended that defibrinated blood had been "beaten to death." Voluntary donors were difficult to find, and the purchase of blood from the poor he considered a base exploitation. He,

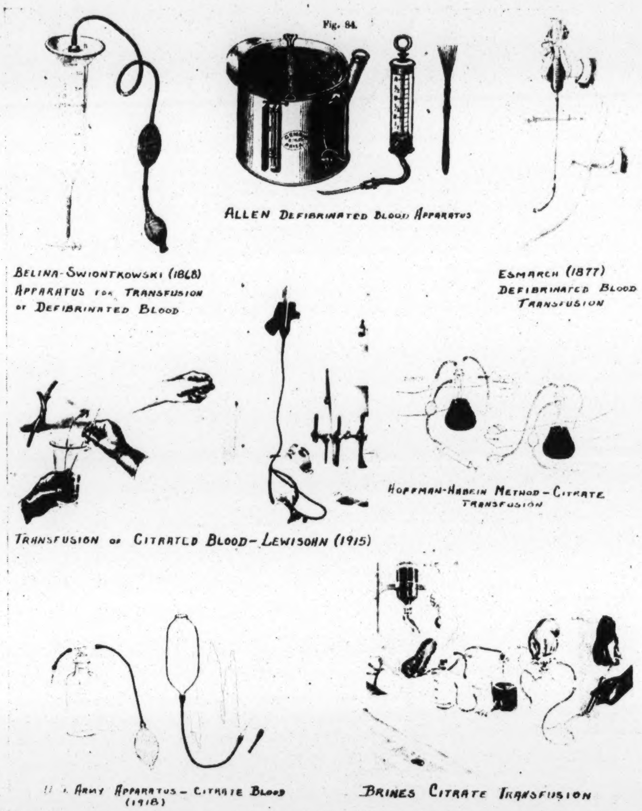
Fig. 84.
Allen Defibrinated Blood Apparatus
Belina-Swiontkowski (1868)
Apparatus for Transfusion of Defibrinated Blood
Esmarch (1877)
Defibrinated Blood Transfusion
Hoffman-Habein Method - Citrate Transfusion
Transfusion of Citrated Blood - Lewisohn (1915)
U. S. Army Apparatus - Citrate Blood (1918)
Brines Citrate Transfusion

FIG. 12. METHODS OF TRANSFUSION OF MODIFIED BLOODS.

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a three-ounce glass aspirator syringe, a fine, blunt-ended aspirator cannula, having a lateral and terminal opening, a short piece of India-rubber tubing with a brass nozzle at either end connecting the syringe with the cannula, a tall, narrow vessel for defibrinating the blood and a suitable vessel floated in warm water to contain the defibrinated blood."

therefore, urged the use of sheep's blood. His cry was taken up by Oscar Hasse, who presented the subject of lamb blood transfusion before the German Surgical Society Congress of 1874, with a report of 31 cases comprising a multitude of diagnoses. His technique, like that of Lower and Denis, consisted of direct transfusion from the carotid artery of the lamb to the cubital vein of the patient, except that he used glass tubes instead of the original quills or silver tubes. The transfusion was continued until the inevitable reaction began, at which time it was interrupted. The symptoms of these reactions he described in great detail; the fatalities were ascribed to causes other than the transfusion. The presentation found little favor at the Congress, and the cynical jest went round, that "for a lamb blood transfusion, the presence of three sheep was always necessary."

Human donors, however, were difficult to find; and even when human blood was used, reactions were frequently severe, and death occasionally followed transfusion. Hueter, in 1870, thought he had discovered a method of eliminating the dangers of transfusion, and predicted the "triumphant entrance" of the procedure into the ranks of everyday operations. His departure consisted of the injection of defibrinated blood peripherally, into the radial or posterior tibial arteries. He believed that this method allowed the injected blood to reach the heart more slowly and uniformly than when intravenously administered and that air embolism as well as toxic reactions could thereby be avoided. Kuester transfused animal blood into the artery, after the suggestion of Hueter, and later performed the first direct artery-to-artery transfusion with human blood. But the arterial operations were, naturally, more formidable than were the venous, and since they carried greater danger, they failed to find the general adoption that Hueter had predicted. About this time (1875–1880), the efficacy of physiological salt solution infusion in the treatment of acute anemias and conditions of shock was demonstrated. Its superiority over blood transfusion was unquestioned; donors were unnecessary, the technique was simple, the solution did not coagulate during administration, and above all, it was safe. It rapidly supplanted blood transfusion, and the latter operation was, therefore, once more virtually abandoned, this time not to be seriously taken up again until the beginning of the present century.

During this interval, tremendous advances were made in the medical sciences. Bacteriology had become established as a science, and asepsis was introduced in surgery; thus the danger of infection during transfusion was largely eliminated. The daughter science, immunology, was also growing rapidly. Bordet found that the injection of blood corpuscles into the blood stream of an animal of another species called forth antibodies in the serum which were profoundly hemolytic for those corpuscles. Ehrlich and Morgenroth amplified this work and demonstrated specific hemolysins in normal sera, for corpuscles of other species.[4] The phenomenon of blood coagulation was being studied by Schmidt, Arthus, Pages, Hammersten and others; it was found that shed blood could be kept from clotting only by avoiding contact with tissue juices or foreign surfaces. Freund demonstrated that coagulation was delayed if blood was received in vessels coated with vaseline, and Bordet and Gengou employed a coating of paraffin for the same purpose. The application of these findings to blood transfusion made it mandatory that only human bloods be used and that, so far as possible, the blood should remain in contact with only intact blood vessel endothelium.

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[4] These findings might have been expected to lay, forever, the ghost of animal blood transfusion, and yet, as late as 1928, a monograph appeared in France by Cruchet, Ragot and Caussimon again advocating transfusion of blood from animals into man!

In the year 1900, Landsteiner (and independently, Shattock) made the momentous discovery which was recently awarded the Nobel Prize, namely, that human blood contains isoagglutinins, capable of agglutinating other human red blood corpuscles; and that human bloods were divided into three groups with regard to their agglutinating reactions. Decastello and Sturli (1902) added a fourth group. Hektoen (1907) was the first to point out the significance of isoagglutinins in human blood transfusions, and their relation to the reactions and hitherto unexplained fatalities from the injection of human blood. Jansky worked out the reciprocal agglutination reactions of the four groups and classified them accordingly. Three years later, Moss, in this country, repeated this work, publishing his own classification, which differed from Jansky's only in the numbering given the groups. Because of the greater accessibility of the later publication, the Moss classification received wide adoption, and consequently the two classifications were in general use simultaneously. This was, of course, both confusing and dangerous. In 1921, a special committee representing organizations of American immunologists, bacteriologists, and pathologists reviewed the question and concluded: "As further confusion and the possibility of accident may be avoided by the universal use of one classification, it is recommended unanimously on the basis of priority that the Jansky classification be adopted."

In spite of this recommendation, however, the two classifications have still persisted (1931). Recently Von Dungern and Hirschfeld have suggested that the Landsteiner classification be adopted, in which the blood groups are named O, A, B, and AB. This classification has the advantage of priority and is rational in that the nomenclature is based on the presence of the antigenic structures of the red blood cells.

The introduction of these important immunological findings into surgical practice was rather slow. Ottenberg (1908) developed clinical methods for typing human bloods, and he was the first to apply agglutination tests in human transfusions. He found that the accidents in transfusion due to the occurrence of hemolysis or agglutination of the donor's blood cells by the patient's serum, or vice versa, could be absolutely excluded by careful preliminary blood tests. This has been adequately confirmed since that time, and the last great danger in transfusion is eliminated.

Placed thus upon a secure footing, and given the great impetus of the World War, with its enormous demand for transfusions in cases of severe hemorrhage and shock, the operation of blood transfusion was finally established in the position it now occupies. The only remaining difficulties had been purely technical in nature, and in the past twenty years, these have been largely eliminated, as innumerable methods and modifications have been introduced to facilitate the procedure. Most of these methods have enjoyed but limited and transient popularity; many of them suffered from their complexity. Time has verified the declaration made by Hueter in 1870, that "the simplest is the best."

The modern era of blood transfusion was ushered in by methods for the direct anastomosis of the vessels of donor and patient. Carrel perfected his method of blood vessel anastomosis in 1905, and for several years transfusions were done by uniting the artery of the donor with the vein of the recipient by the suture method. This offered continuous, unbroken endothelial surface, thereby preventing contact of the blood with any foreign substance. It required a formidable operation, however, and a delicacy of technique that limited its use to accomplished surgeons, experienced in blood vessel surgery. Crile, in 1907, introduced his method of cuffing the artery back over a cannula, and tying the vein over it; and he described a cannula for the purpose. This greatly facilitated the operation, and, together with its many modifications (Elsberg, Jeger, Soresi), was the preferred method for a number of years. To simplify the procedure still further, recourse was again had to the simple, cylindrical cannula (Brewer, Morel), similar to those used by Lower and Denis in the earliest transfusions. Bernheim (1912) described a set of two tubes, one for the artery and one for the vein, which fitted into one another. This is almost identical with the first method of transfusion proposed by Libavius in 1615.[5] All these methods of direct transfusion, however, required the sacrifice of an artery of the donor. Moreover, it was impossible to measure the amount of blood transfused, there was danger to the donor in infectious cases, and mishaps due to clotting of blood, or severing of the anastomosis by motion on the part of either patient or donor, were distressingly frequent. Consequently, with the advent of simple and reliable indirect methods of transfusion, the direct methods were more and more infrequently employed, until today they are no longer in use.

In 1911, Curtis and David applied to the practice of transfusion the principle demonstrated years before, that blood introduced into vessels coated with paraffin remains uncoagulated for a considerable time. Their apparatus consisted of a paraffin-coated vessel, connected with a syringe, and having two outlets; through one of these the blood was drawn in from the vein of the donor, and through the other, it was injected into the patient. Two years later Kimpton and Brown utilized the same principle in the development of the Kimpton tube, which was subsequently modified by Percy, Vincent and Schlaepfer, and which is still rather widely used today.

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[5] Andreas Libavius wrote in 1615: "Let there be a young man, robust, full of spiritous blood, and also an old man, thin, emaciated, his strength exhausted, hardly able to retain his own soul. Let the performer of the operation have two silver tubes fitting into each other. Let him open the artery of the young man, and put into it one of the tubes, fastening it in. Let him immediately after open the artery of the old man, and put the female tube into it, and then the two tubes being joined together, the hot and spiritous blood of the man will pour into the old one as it were from a fountain of life, and all of his weakness will be dispelled."

In the same year (1913), Lindeman revived a method described by Ziemssen in 1892, consisting of the use of multiple large syringes, which were successively filled from a cannula in the vein of the donor and emptied through a second one in the vein of the patient. With slight modifications, this method is used at the present time. It is somewhat cumbersome, however, and requires the coordinated action of several operators; otherwise the blood is very likely to clot in the syringes or needles, with annoying and time-consuming consequences. To eliminate these possibilities, and to simplify the procedure, a number of devices have been suggested, some of which were equipped with valves permitting the alternate aspiration and injection of blood, without disconnecting the syringes. These bear a striking resemblance, in general, to the many apparatuses developed by Blundell and his successors during the 19th century. McGrath (1914) revived the once popular Aveling apparatus, substituting for the more complicated original device a large rubber bulb with two lateral tubular prolongations to be inserted into the veins of donor and recipient. Alternate compression of the tubes permitted repeated aspiration from the donor and injection into the patient. DeLee substituted a syringe with a T-tube attachment for the same purpose, as, indeed, had Curtis and David in 1911, with their original, paraffin-coated Y-tube. Unger (1915) devised a four-way valve syringe attachment, in which the outlets to the donor and recipient were alternately connected with the syringe and with a reservoir of saline or citrate solution. Many variations of these instruments (Bernheim, Janes, Scannell) have been employed, some being successfully used today.

The greatest source of difficulty with these and the afore-mentioned methods of transfusion was the clotting of blood in the apparatus. As has been brought out, attempts have been made for the past one hundred years to render blood incoagulable by physical or chemical treatment. The transfusion of defibrinated blood was largely abandoned following the work of Koehler, in 1877, who demonstrated that blood so treated contained an excess of fibrin ferments which exerted a hemolytic action on the cells of the recipient, and which were also the potential source of coagulative changes. Although Fuld, Morawitz and others showed that these harmful effects could be overcome, the use of defibrinated blood for transfusion has been very limited in the modern period.

Landois (1892) suggested the use of hirudin to keep the blood from clotting, and Satterlee and Hooker, after a comprehensive study of the various anticoagulants which had been used, attempted to utilize this substance in transfusion. The difficulty of obtaining adequately pure and reliable preparations of hirudin and the narrow range between the effective and toxic doses of the drug prevented this method from finding wide employment. Hustin of Belgium, in 1914, reported his experiments on the use of sodium citrate and glucose in preventing coagulation of blood. In the following year, Agote of Buenos Aires and Lewisohn and Weil independently, in this country, advocated the use of sodium citrate alone, for the purpose of rendering blood incoagulable during transfusion. This method made the operation extremely simple, safe and practical; transfusions could now be done by the surgeon without specially trained assistants with very little inconvenience to the donor and without disturbing the patient. During the war the citrate method became the standardized practice in military service; and since that time, it has been in very wide use. Although there is some difference of opinion as to the incidence of increased reaction, the recuperative value, and the antibody content of citrated blood, it has been adequately demonstrated that the drug is non-toxic in the concentration necessary to keep the blood incoagulable (0.2 per cent).

The last chapter in the story of blood transfusion has probably not yet been written. It is the story of three centuries of strange vicissitudes, of a popularity which has ebbed and flowed periodically, and of the eventual recognition both of the value and limitations of blood transfusion. Hardly more than a myth to the ancients, and to the early Renaissance scientists, a belief based largely on superstition and hope, the transfusion of blood is, today, firmly established as a practical therapeutic measure, securely based on scientific fact, safe, and with several simple, carefully developed techniques for its use.

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SWEDENBORG ON THE THEBESIAN BLOOD FLOW OF THE HEART

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COMPARISON of the Thebesian passages[1] in the mammalian heart with the twigs of the nutritional *vasa vasorum* of the great vessels suggests a similar entrant function. Such analogy is perhaps strengthened by the fact that the heart is itself a modified blood vessel. Although the long accepted status of all endocardial openings as venous exits is not to be ignored, nevertheless the isolated heart can be maintained in rhythmical activity by simple introduction of blood under low pressure into a closed ventricle; and it has been shown that in this event there is a perfusion into the superficial coronary veins.[2] On this basis the Thebesian vessels have been accorded provisionally a rôle in the maintenance of life under the depleted vascular conditions imposed by obstructive disease of the coronary arteries.[3] The large combined capacity of the cardiac sinusoidal system (which includes these veins of Thebesius or *venae cordis minimae* of the anatomists) has since been remarked by various observers,[4] and cases in man have been described in which active survival over an appreciable time has accompanied complete pathological occlusion of both coronary trunks.[5]

The point of view just outlined has a background of unusual historical interest. This rests upon the quite unsuspected evidence, first brought to my attention through the kindness of Dr. John P. Sutherland,[6] that the earliest formulation of a nutritional hypothesis for the Thebesian vessels is to be found in the physiological writings of Emanuel Swedenborg (1688–1772), eminent physicist and engineer of Sweden in the reigns of Charles XII, Ulrica Leonora and Frederick I; more familiarly known through his later works as theologian and seer.

Swedenborg's biological studies,[7] largely confined to a few years of intensely concentrated effort in the European centers of anatomy (1736–40), prefaced his entrance upon the purely theological phase of his career and, being transitional in character, must in justice be classed apart from his earlier vast accomplishments in pure and applied physical science.[8] The published results do, however, indicate recourse to the best scientific authorities of that day[9] as the point of departure for his reasoning. While his efforts reach a highly speculative and eventually a physiomystical stage, yet they have left amazing evidence of analytical power and constructive thinking. The outstanding example of this is his distinct recognition, based on contemporary neurological data (which include unquestionably the results of his own observations), of the cerebral cortex as the organ of the mind, of cortical localization and of the continuity of the "cerebellula" (cortical cells) with fibers governing subordinate stations in brain and cord.[10] Prescience seems almost to dwell in such an achievement—half a century before (and far outvisioning) Gall; a century before Schwann; a century and a half before Waldeyer!

Servetus' theory of the pulmonary circulation was integral to a work frankly theological. Swedenborg, on the other hand, in his search for the inmost "domain of the soul" followed a consistent plan of study of the human body. "I am determined," he says, "to allow myself no respite, until I have run through the whole field to the very goal."[11] Thus, in a work with a biophilosophical objective that Servetus would disclaim, he becomes the pioneer of the cortex in the same sense that the latter is the pioneer of the lesser circulation. Their methods, as pointed out by Nordenskiöld,[12] are the same: both possessed anatomical experience, probably of the best quality available; both arrived at their conclusions through speculative deduction. Indeed, in Swedenborg's theory of cardiac nutrition the perilous nature of a one-time legitimate method of enquiry is exemplified as well as the genius of the thinker; for it will be seen that the whole mechanism of his argument, with whatever virtue of suggestion it may contain for present-day theory, owes its inception to the slipping of the first cog in the train of reasoning.

In his elaborate treatment of the coronary system in Chapter VI, Part I of "Œconomia regni animalis" Swedenborg maintains, first, that through the probable occlusion of the coronary orifices by the aortic valve-flaps (a contentious thesis of his day), or in any case through systolic compression of the coronary trunks, no blood can enter these vessels in systole; secondly, that even diastolic filling of the coronaries must be precluded by lack of propulsive force at the root of the aorta after systole has taken place. Therefore, he argues, the coronary arteries are to be looked upon as veins feeding directly into the aorta,[13] and some other route of nutrition must be invoked for the myocardium.

In the catalogue of Swedenborg's personal library, published at Stockholm[14] in the year of his death, Item 30 of the quartos is entered as follows: "Lancisius de Motu cordis c. fig. Neap. 1738." So at the time of the writing of the "Economy" there was a fresh imprint of Lancisi's work, which was presumably used in quoting the following passage on the endocardial foramina of Vieussens' "fleshy ducts":

> That the blood alternately goes in and out, with a kind of ebb and flow, through the before-mentioned diverticula of the [coronary] veins, seems to be proved by what we have observed in regard to the lips of these orifices. For these lips are not rough, uneven, or edged, but always smooth and polished; making it probable, that the liquids smooth down the margins of these little mouths by their passage to and fro, as it were by the chafing of a fine and delicate pumice. [¶408][15]

It would seem, then, that Giovanni Maria Lancisi the anatomist (1654–1720) is responsible in the assumption of an "ebb and flow"[16] for the germ of the idea so richly elaborated by Swedenborg, who, after expressing the wish that Ruysch might here have applied his renowned wax injection methods, continues thus:

> What now can be plainer than that the blood expressed from the lacunae [intertrabecular crypts] into the ducts is forced into the motive fibres, and prompts and urges them to diastole or reciprocal action. For, 1. Orifices that spread into ramifications, visibly open in the lacunae or under the columns. 2. The first blood that comes is received under these coverings, and in these crypts, and when once received, cannot be wrung out into the

larger artery; for when the heart is constricted, it is compressed directly towards these lacunae whenever it is compressed towards the intermediate septum.[17] 3. The blood of the common ventricle presses upon it, and the particular walls or columns, which are muscular, likewise press upon it. 4. By the continual washing of the blood, the mouths, together with the ducts, are smoothed down, as if by the chafing of the finest pumice. 5. The blood injected into them, is diffused through the substance of the heart, in the same manner as any other liquor, according to the experiments adduced.[18] 6. Part of the blood also passes into the coronary veins, and part of it regurgitates. [¶408]

It is of note that Swedenborg's relational conception of the intramural vessels will bear close comparison with modern views, which are themselves to an extent under dispute.[19] In this, however, as throughout most of the treatise, the reader is hampered by the author's leading premise, the nullification and functional reversal of the coronary arteries, and hence is inclined to discount the force of his ingenious analysis:

> . . . let us, by induction from what we have stated, yet still with experience at our side, ascertain how the blood is carried downwards from the lacunae, through these ducts into the muscular substance of the heart, and how it is carried downwards into the coronary vessels. One thing is evident, that there are ducts leading into the muscular substance of the heart, and which we shall call *Immissaries* [Thebesian-capillary system]; that there are also ducts leading from the muscular substance into the coronary vessels, and which we shall call *Emissaries* [coronary venules and arterioles?]; and that there are ducts leading immediately from the lacunae into the coronary vessels, and from these back into the lacunae, and which we may call *Commissaries* [Thebesian-arterial, Thebesian-venous anastomoses]. [¶409][20]

The flow in this intervascular system with reference to the heart cycle is thus conceived:

> Further; during the systole of the heart there is no other exit for the blood than through the large arteries, namely, the pulmonary artery and aorta, and at the same time through those fleshy ducts towards the muscular substance of the heart, and at the same time from the muscular substance into the superficial vessels; in a word, through all the immissaries and emissaries, but not through the commissaries. But when the heart returns to its diastole or expansion, these ducts are closed, and the others are opened; namely, the communicatory or commissary; so that by these means the blood can be driven freely from the coronary vessels into the ventricles, and back again. [¶410]

Thus the ebb and flow are assigned each to its respective vascular entities among the *ductus carnosi*, the immissary constituents of which, to italicise the author's words, "*are so many small and proper arteries of the heart, and have their own small and proper ventricles or chambers, which we have denominated lacunae.*" [¶412]

Most vivid is the picture of the same mechanism drawn by Swedenborg's Victorian disciple, biographer and translator, J. J. G. Wilkinson, M.R.C.S.:[21]

> Now what structures do we find upon those walls, but caverns, jagged cavities, and at the bottom of these a number of little holes, the foramina of Thebesius. Into these caverns then, miniature ventricles in the great ventricle, hearts of the heart, the quickest blood is received, and the pores open with all their hearts to take it in. And when the heart contracts, it drives out the general blood of the body into the grand aorta, but its own par-

ticular blood, detained in the cavernous lacunae, it squeezes, slippery with spirit, through its walls into its muscular substance, and thence onwards and outwards to the surface, into the coronary arteries and the coronary veins, from which there is a reflux, when necessary, into the auricles and ventricles. [p. 208] . . . If the heart is a hand that grasps,[22] it is also a person that gets; it is a very lord of its own objects. The caverns with which it is sculptured, are so many means for retaining the blood; the little mouths with which these are studded, are eagerly absorbent and retentive; and as the heart contracts, it fills its substance with immediate blood, by the same act with which it drives the mass of the blood into circulation [p. 238] . . . the heart absorbs its own blood through its walls, and does not depend upon the coronary rills for its supply, which would beggar it of what it grasps, and put an end to its motives for contraction. [p. 240]

The reactionary tenor of this adorned version (note the nineteenth-century resurgence of the *pneuma*) need not blind us to its essential reasonableness. Truly the heart *is* a "hand that grasps," and that powerfully. The cross-section of the systolic as compared to the diastolic ventricle shows the dense crowding of the trabecular columns and network, with suppression of the intertrabecular spaces —the geometrical consequence of the thickening of a wall of constant cross-sectional area as the content of the lumen diminishes.[23] Swedenborg's lacunae are thus constricted; in fact, virtually obliterated. Is the heart also in this respect a "person that gets"? Has the grasp of the lacunar walls served actually to inject the entrant sinusoids rather than merely to return the blood to the main cavity of the emptying ventricle?[24] The situation is quite conceivable, but conditioned by differential pressure states far beyond *a priori* judgment even if, through coronary occlusion, the intramural vascular pressures were to approach zero and thus cause the initial Swedenborg postulates in effect to come true. Evidently, however, some such hypothesis must be entertained in any experimental attack upon the problem of vicarious nutrition.

For over one hundred and fifty years the fleshy ducts so well known to Swedenborg and his contemporaries remained hardly approached physiologically, and even the recognition of their existence became at length obsolescent. It is somewhat amazing that so bold and detailed a thesis as has here been excerpted had failed through all this period to yield its suggestion. The unquestionable priority established thus documentally by Swedenborg for the origin of a nutritional view of the Thebesian vessels is evident. Of equal importance is his provision of an hypothesis, based on the experimental anatomy of the best investigators of his time, to account mechanically for the assumed influx through these passages. And it is of peculiar interest that the basic assumption in his argument (negation of arterial coronary flow) reflects, if we are willing to ignore the substituted antidromic coronary relation to the aorta, essentially the situation attained pathologically in coronary occlusion. In fact without such an assumption the theory has, as viewed today, a less clear significance; for light is still uncertain on the normal economy of the *ductus carnosi*.

NOTES AND REFERENCES

1. Their scattered openings upon the interior heart walls (Thebesius, 1708)

were first described by Vieussens in 1706 as the orifices of "fleshy ducts" (*ductus carnosi*); yet Galen the great observer, if seeking ocular evidence for his theory of a porous septum, could hardly have missed their often profuse distribution (conspicuous in ungulates) on the septal walls. Leake, in his recent translation of Harvey (Ed. 2, Springfield, Ill., 1930) notes a like possibility. Harvey denied in no uncertain terms the existence of any such perforations, and apparently closed the question; it does not seem to recur in connection with the fleshy ducts, although they appear quite capable of conveying the modicum of blood required by the Galenian theory. Leonardo's acceptance of the pores may thus claim better justification than that accorded by McMurrich ("Leonardo da Vinci—the Anatomist," 1930, p. 156).

2. Pratt. *Am. J. Physiol.*, 1: 86, 1898. The possible implications of these results, pathologically, were first pointed out to the writer by his friend and teacher, Professor W. T. Porter, in 1897.
3. Experimentally, a reverse flow through the coronary sinus will likewise nourish the excised heart (Pratt, *loc. cit.*). Batson and Bellett (*Am. Heart J.*, 6: 206, 1930) conclude from their injections *in vivo* that such is the more probable route for vicarious supply. The results of Wearn (*J. Exper. Med.*, 47: 293, 1928) favor, on the other hand, the Thebesian passage. As a contributing factor, nutritional absorption by the trabecular network is to be considered (Pratt, *Boston M. & S. J.*, 190: 8, 1924).
4. Crainicianu. *Virchows Arch. f. path. Anat.*, 238: 1, 1922; Wearn, *loc. cit.;* Kretz, *Virchows Arch. f. path. Anat.*, 266: 647, 1927.
5. Leary and Wearn. *Am. Heart J.*, 5: 412, 1930.
6. March, 1929. I am since indebted to Professor G. Liljestrand of Stockholm for valuable references, and to Mr. B. A. Whittemore for kind assistance in the use of the library of the Massachusetts New Church Union in Boston, which contains a fine original copy of the *Œeconomia.*
7. Known mainly in Œconomia regni animalis (1740–41) and Regnum animale (1744). The customary English rendering of the titles is unsatisfactory. It is the human "soul's domain" that is explored. The intent is far from zoological.
8. See the classified list of these earlier works (Acton, Swedenborg Scientific Assoc., Phila., 1919). The interesting *Transactions* of the International Swedenborg Congress, 1910 (Lond., 1912), contain compendious information and discussion on all aspects of the subject, and are unique in bringing together under one motive the contributions of many intellects of the utmost diversity.
9. Haller, in characterizing the scope of Œconomia, writes: "Primum anatomen praefigit, ex bonis auctoribus collectam . . . deinde subjungit physiologiam, hanc *suam & omnino mirificam.*" (Bibliotheca anatomica, etc., II: 328, 1777.) According to this, authoritative anatomy is Swedenborg's background for his "original and in every way remarkable" physiology. As a trained observer, his recourse to authority appears to have been judiciously and advisedly undertaken for reasons stated in the *Œconomia*, ¶s 17 and 18.
10. Retzius, G. *Verhandl. d. Anat. Gesellsch.*, XVII Versamml., Heidelberg, 1903; *also*, Croonian Lect., *Proc. Roy. Soc.*, B, 80: 414, 1908; Ramström, Emanuel Swedenborg's Investigations in Natural Science, etc., Upsala, 1910; *also*, *Trans. Internat. Swedenb. Cong.*, 1910, p. 56.
11. Regnum animale, ¶ 19. (Wilkinson's Transl., Am. Ed., Cincinnati and Boston, 1858).
12. The History of Biology (Stockholm, 1920). Transl. by Eyre, N. Y. and Lond., 1928.
13. It is difficult to excuse this lapse, in spite of the contemporary reasons urged, except on the assumption that experimental verification was deemed impossible.
14. 1772. Four hundred seventy titles, mainly scientific and medical. Reprinted in facsimile; A. H. Stroh, Ed., Stockholm, 1907.
15. The American edition (Boston, 1868) of Clissold's translation is quoted in this and following extracts. It should be understood that Swedenborg is meticulous in citing his own authorities. The

translator has verified and particularized each citation.

16. As quoted by Swedenborg from the original: "vicissim egredi ingredique ad instar Euripi" (Lancisi, De motu cordis, I, prop. 46).

17. *Cf.* Walmsley, The Heart, 1929 (Quain, iv, part iii, 65): "In the right ventricle the free lateral wall carrying the anterior papillary muscle is approximated to the septal wall, and in the apical part of the heart the cavity is obliterated by the apposition of the trabeculae." (p. 65.) *Cf.* also Œconomia, ¶s 418 and 420.

18. Referring to the injection methods of authorities previously quoted by him.

19. *Cf.* Wearn, *loc. cit.;* Grant and Vico, *Heart,* 15: 103, 1929; Mettier and Wearn, *Trans. Acad. Am. Phys.,* 44: 345, 1929; Batson and Bellett, *loc. cit.* Pratt (1898) and Grant and Vico found no proof of the Thebesian-arterial anastomoses described by Vieussens and others, and accepted (as follows) by Swedenborg; but Wearn, and Mettier and Wearn, present strong evidence of such connections.

20. It is striking to compare this category with the vascular schemata of Wearn and of Batson and Bellet.

21. The Human Body and its Connexion with Man (dedicated to Henry James [Sr.], Esq. of New York), Lond., 1851. (The copy of reference is from the library of Theodore Parker and bears his autograph.)

22. In another place: "With quadrumanous hands it clutches the passing lifestream." (p. 225.)

23. Krehl: Beiträge zur Kenntniss der Füllung und Entleerung des Herzens, *Abhandl. d. Königl. sächsischen Gesellsch. d. Wissensch.,* 19, 1891. Math.-physische Classe, 17: 341 (*cf.* esp. pp. 349–50 and Pl. iii). The exquisite drawings by Max Brödel illustrating the article show impressively the lacunar complexity of the heart walls as well as the compressive effects of the systolic state.

24. Kretz's view is affirmative: "Through the shortening of the muscle fibres the clefts between the trabeculae into which the Thebesian vessels open are deepened and extended and, by the diminution of the heart lumen, the blood is squeezed from the heart cavities into the Thebesian vessels." (*Loc. cit.,* pp. 666–667.) Ganter (Handb. d. nor. u. path. Physiol. Berlin, 1926, vii/1, Teil 1, p. 389), in course of reference to Crainicianu's work, notes the possibility of cardiac massage effecting just such an injection. Stella (*J. Physiol.,* 73: 36, 1931) maintains, on the other hand, from experiments with the heart-lung preparation that in no part of the cardiac cycle are conditions favorable to any significant reception of blood by this route, even in event of low coronary pressures; this author is not in accord with Wearn and the early anatomists as to free arterio-Thebesian connections. More recent experiments of Stella continue to support his conclusions (*J. Physiol.,* 75: 18, 1932). It is clear that the whole problem awaits a consistently recognized structural basis.

WILLIAM SHIPPEN, JUNIOR*

By WILLIAM SHAINLINE MIDDLETON, M.D.

MADISON, WIS.

RUSCHENBERGER epitomized the career of William Shippen, Junior, one of Philadelphia's medical dignitaries of the Revolutionary period, as follows:

> If he contributed anything to the literature of either medicine or science, it has not been found. His claim to the enduring approbation of his fellow-citizens mainly rests on his being the pioneer of systematic teaching of anatomy and surgery in Philadelphia, for which he was eminently qualified. His skill, his eloquence as a teacher, exercised during forty years in the first medical school of the country made him widely known at home and abroad, and won for him permanent distinction and respect in the medical world.

The Shippens were a prominent family in Philadelphia throughout the colonial period. The American branch of the family had its roots in the substantial person of Edward, the great-grandfather of William, Junior. This ancestor first settled in Boston and later moved to the more congenial Quaker settlement on the Delaware at the invitation of William Penn. So influential was he in affairs of state that at one time or other he held practically every office of trust under Penn, who was the guest of honor in the Shippen home during his second visit to Pennsylvania. The first Shippen was locally famous in three physical details, as possessor of "the biggest person, the biggest house and the biggest coach" in the province. The gardens surrounding the Shippen home were unsurpassed in the colonies. The second generation of Shippens seemed not to possess the civic conscience of the elder Edward; but in the persons of the brothers Edward and William, Senior, there occurred a reincarnation of the earlier force in the third generation. The latter Edward was active in every movement for the common weal and was the father of the even more famous jurist.

William, Senior, father of the subject of this sketch, was one of a very active group of medical men in colonial Pennsylvania, who, although denied the advantages of systematic medical training in a university, embodied the highest ideals of the profession in their practice and laid the foundations for an unrivalled medical tradition in Philadelphia. He served his apprenticeship as a house-pupil of the senior John Kearsley and by self-training became proficient in chemistry and natural philosophy. The return of Thomas Cadwalader, a pupil of Cheselden, to Philadelphia was the occasion for a voluntary course in anatomy, to which Shippen lent himself most assiduously. This circumstance was to have a profound influence upon the training of his son. William Shippen, Senior, has been characterized by his contemporaries as a most equable and benevolent individual. Among his prominent activities should be listed active membership in the American Philosophical Society, that of a founder and trustee of the College of Philadelphia and a similar relationship to the College of New Jersey. He was a delegate to the Continental Congress from Pennsylvania for two terms, and for twenty-five years served faithfully on the staff of the Pennsylvania Hospital.

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* Read before the Medical History Seminar, University of Wisconsin, at the home of Dr. William Snow Miller.

Into this environment of public service, William Shippen, Junior, was born October 21, 1736. He was exposed to this influence throughout his childhood and youth, until he was sent to Nottingham in Chester County, Pennsylvania to receive his preliminary education under the justly renowned Rev. Dr. Finley who later became the president of the College of New Jersey. The school at Nottingham apparently grounded its students thoroughly in the classical languages. From here he entered the College of New Jersey in Newark, which at that time was the only institution of such rank in the colonies, between New Haven and Williamsburg. In due time Shippen completed his academic course with distinction.

His commencement oration was the occasion of high commendation from the evangelist George Whitefield who was in the audience. The latter urged him to enter the ministry. Whitefield was then at the flood of his remarkable career which was to sway the English-speaking peoples, and was by some acclaimed a public benefactor and by others a charlatan. For example, Benjamin Franklin said, "I knew him intimately upward of thirty years. His integrity, disinterestedness and indefatigable zeal in prosecuting every good work, I have never seen equalled and shall never see excelled." On the other hand, Samuel Johnson remarked:

> Whitefield never drew as much attention as a mountebank does; he did not draw attention by doing better than others, but by doing what was strange. Were Astley to preach a sermon standing on his head on a horse's back, he would collect a multitude to hear him; but no wise man would say he had made a better sermon for that. I never treated Whitefield's ministry with contempt; I believe he did good. He had devoted himself to the lower classes of mankind, and among them he was of use. But when familiarity and noise claim the praise due to knowledge, art, and elegance, we must beat down such pretenses.

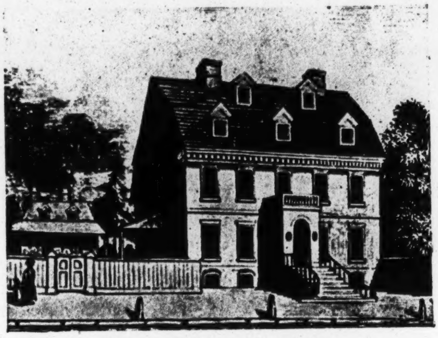


Fig. 1. The Shippen House.

Be that as it may, Whitefield's word carried great force in America and it may be concluded that his advice to the young Shippen was seriously considered. As evidence of the favor in which he was held by the Shippen family a letter under date of October, 1774, from Edward to William Shippen, Senior, may be quoted, "I thank you for Wesley's funeral sermon upon our deceased, heavenly, mutual friend, G. W. I am sorry you had not an opportunity of presenting him with the proposed Doctorate from our Nassau Hall. Such a thing would have been a great honour to him." Ultimately the father's earlier resolution held and William, Junior, became an apprentice in his office for the ensuing three years.

Shortly after his twenty-first birthday, Shippen left for Great Britain to complete his medical education. He immediately became a house-pupil of John Hunter and was zealous in his attendance upon this master as well as Hewson and William Hunter. The desire for wider obstetrical training led to Shippen's change of residence to the poorer district of London, where under the instruction of McKenzie he attained a marked proficiency in midwifery. To the enthusiastic advocacy of this young medical student, Philadelphia, or more particularly the Pennsylvania Hospital, owed the munificent support of Dr. John Fothergill. Apparently this prominent Quaker physician of London was greatly impressed by Shippen and took active measures to further his professional interests not only in England but materially on his return to America.

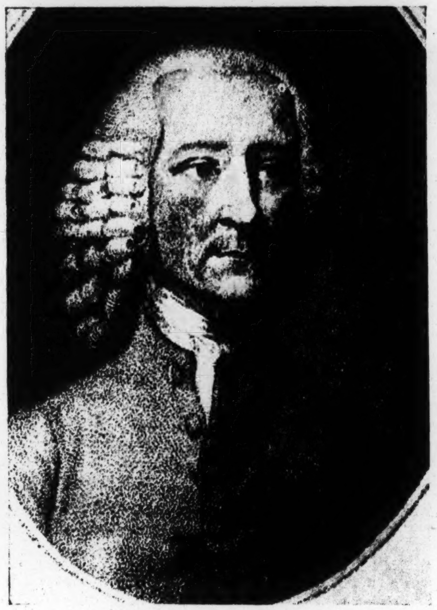


FIG. 2. JOHN FOTHERGILL.

Edinburgh was naturally sought as the proper institution from which a colonial medical student should obtain the doctorate. Cullen was a great force in the medical world of that day and Monro *primus* was closing a most illustrious career in that university. To these great teachers the fame of the medical school may be largely ascribed. A letter from Benjamin Franklin to William Cullen, October 21, 1761, indicates the former's active interest in behalf of Shippen: "I thank you for the civilities you were so good as to show my friend Mr. Shippen, whom I took the liberty of recommending to your notice the last year." Little of interest relative to Shippen's stay in Edinburgh has been preserved. At some time during his British sojourn, probably while in London, Shippen married the daughter of Thomas Lee, a highly respected citizen of Virginia, at one time president of the Governor's Council of that colony. Shippen's thesis for the doctorate was entitled "De placentae cum utero nexu" and was interesting as indicating his early inclination toward obstetrics.

All American students of this period deemed a continental tour essential to the proper rounding out of a medical education; but hostilities between Great Britain and France for a time seemed to preclude such an arrangement. Finally through the intervention of Sir John Pringle, Shippen secured an appointment as medical attendant upon a tuberculous patient for whom residence in France had been prescribed. Accordingly diplomatic intercession was made by George II in Shippen's behalf and the latter spent a season in Paris, where he made the acquaintance of Senac and other prominent physicians.

In 1762 after an absence of five years Shippen returned to Philadelphia with two avowed purposes, namely to teach anatomy and to elevate the practice of midwifery to a dignified plane. Before entering upon these professional ambitions, a contemporary picture of his person and personality at this stage of life has been afforded by Caspar Wistar:

> Nature had been uncommonly bountiful in his form and aspect; his manners were extremely elegant; his pronunciation was fine; he belonged to a family, proverbial for good temper; his father during the long life of ninety years, had scarcely ever been seen out of humour; and he had a strong resemblance to his father. In his intercourse with men, he was perfectly at his ease with the most stately—he could converse with the most ignorant so as to make them easy, but without affecting ignorance himself; he could mix with the lowest orders of society, without imposing a painful restraint on them, whilst he preserved the manners of a well-bred gentleman. He was also particularly agreeable to young people. At this period he was known to almost every citizen of Philadelphia, and yet it is probable that there was no one who did not wish him well.

So favored, William Shippen, Junior, began the practice of medicine with his office in Second Street between Walnut and Spruce Streets. No time was lost in his avowed purpose of giving private instruction in anatomy. The promised assistance of Fothergill materialized in the announcement of a meeting of the hospital managers in the Warden's Room at the Court House on November 8, 1762. The proceedings of the meeting state that members of the medical staff, the Bonds, the senior Shippen, Redman and Evans, were present "at the request of Doc'r William Shippen, Jun'r, lately arrived from London." The younger Shippen bore the tidings of the recent arrival of seven cases of anatomical drawings and models, the gift of Dr. John Fothergill. The collection was valued at £350 and consisted of eighteen crayon drawings, three cases of anatomical models and one case containing a skeleton and a fetus. Jenty of London was the prosector for the anatomical preparations. Rimsdyck in turn did the crayons. As the donor had requested, Shippen's application for permission to use these materials in the private teaching of anatomy was granted.

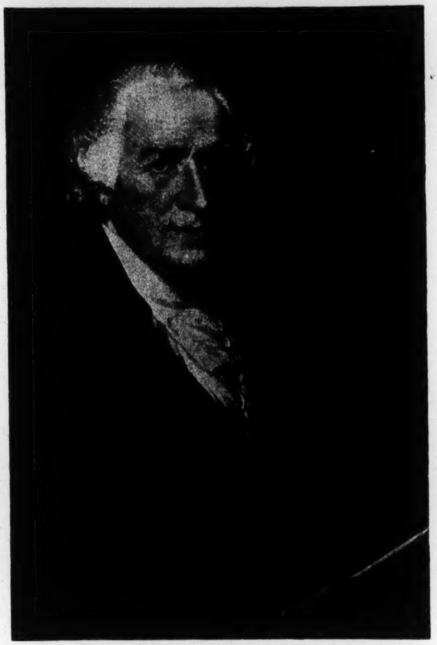


FIG. 3. WILLIAM SHIPPEN, JUNIOR.

Announcement of his proposed course appeared in the *Pennsylvania Gazette*, November 11, 1762:

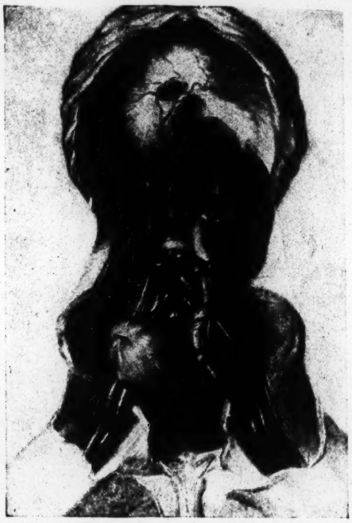
> Philadelphia, November 11,
> Mr. Hall, Sir,
>
> Please to inform the Public, that a course of anatomical Lectures will be

opened this winter in Philadelphia, for the Advantage of the young Gentlemen now engaged in the Study of Physic, in this and the neighboring Provinces, whose Circumstances and Connections will not admit of their going abroad for Improvement to the Anatomical Schools in Europe; and also for the Entertainment of any Gentlemen, who may have the Curiosity to understand the Anatomy of the Human Frame.

In these Lectures the Situation, Figure, and Structure of all the Parts of the Human Body will be demonstrated, their respective uses explained, and, as far as a Course of Anatomy will permit, their Diseases, with the Indications and Method of Cure, briefly treated of; all the necessary Operations in Surgery will be performed, a Course of Bandages exhibited, and the whole conclude with an Explanation of some of the curious Phaenomena that arise from an Examination of the Gravid Uterus, and a few plain general Directions in the Study and Practice of Midwifery.

The necessity and public Utility of such a Course in this growing Country, and the Method to be pursued therein, will be more particularly explained in an Introductory Lecture, to be delivered the 16th Instant, at Six o'Clock in the Evening, at the State-House by William Shippen, jun. M.D.

N.B. The Managers and Physicians of the Pennsylvania Hospital, at a special Meeting, have generously consented to countenance and encourage this Undertaking; and to make it the more entertaining and profitable, have granted him the Use of some curious Anatomical Casts and Drawings (just arrived in the Carolina, Capt. Friend) presented by the judicious and benevolent Doctor Fothergill, who has improved every Opportunity of promoting the Interest and Usefulness of that noble and flourishing Institution.


FIGS. 4 AND 5. REPRODUCTIONS OF CHARACTERISTIC FOTHERGILL CRAYONS.

The introductory lecture, given in the State House, was well attended by the intelligentsia of Philadelphia. Thereafter twelve students registered for Shippen's course, the first systematic one in anatomy in North America. The financial arrangements for this course were stated in the *Pennsylvania Gazette* of November 25, 1762:

> Dr. Shippen's Anatomical Lectures will begin To-Morrow Evening, at Six o'Clock, at his Father's House in Fourth-Street.
>
> Tickets for the Course to be had of the Doctor, at Five Pistoles each; and any Gentlemen who incline to see the Subject prepared for the Lectures, and learn the Art of Dissecting, Injecting, & C. are to pay Five Pistoles more.

Shippen met the Managers at the London Coffee House and proposed a more or less popular demonstration of the Fothergill collection to be given twice a month at the hospital under his supervision. In accordance with this suggestion the following announcement appeared in the public press:

> The Generous Donation of Doctor Fothergill of London to the Pennsylvania Hospital of a Set of Anatomical Paintings and Castings in plaister of Paris representing different views of the Several parts of the Human body being now deposited in a Convenient Chamber of the Hospital. As there may be many Persons besides Students in Physic desirous to gain some general knowledge of the Structures of the Human body;
>
> Dr. William Shippen jun'r. proposes to attend there on the seventh day of the Week at 5 o'clock P.M. and once a fortnight on the same day of the Week at the same hour during the summer session to explain & demonstrate to such persons who are willing to give a Dollar each for the benefit of the Hospital.

For three years Shippen conducted his private courses in anatomy independent of any other physician and of any educational institution. In 1765 John Morgan returned to Philadelphia after a protracted period of training in Europe. He immediately made known his plan for medical education in a masterly address before the College of Philadelphia. His proposal was accepted; and upon the basis of his prior appointment and his constructive plan which remains a document of acknowledged merit both from the historical and from the educational viewpoint, most students of medical history in America credit Morgan with the responsibility for the foundation of the first medical school in North America.

Krumbhaar has wisely concluded that there is glory enough for both of the principals in this worthy enterprise; but a critical sense of justice demands the investigation of the claims of each before the gathering years further befog the issue. The case for John Morgan must rest upon the very strong evidence contained in his superior inaugural, "A Discourse upon the Institution of Medical Schools in America." Of course, some force for his prior claims rests also in his earlier appointment to a professorship in the proposed medical school. In 1789 Benjamin Rush, who was by no means a partisan of Shippen, remarked "that it was during his [Morgan's] absence from home that he concerted with Dr. Shippen the plan of establishing a Medical School in this city." A letter from Fothergill to James Pemberton of Philadelphia under the date of April 7, 1762 contains a passage which has been used as the strongest evidence in support of Shippen's prior claim, to wit:

> I have recommended it to Dr. Shippen to give a Course of Anatomical Lectures to such as may attend, he is very well qualified for the subject and will soon be followed by an able Assistant Dr. Morgan both of whom I apprehend will not only be useful to the Province in their Employment, but if suitably countenanced by the Legislature will be able to erect a School for Physic amongst you that may draw many Students from various parts of America & the West Indies & at least

furnish them with a better Idea of the Rudiments of their Profession than they have at present the Means of acquiring on your Side of the Water.

Undoubtedly Fothergill's judgment of the relative merits of Morgan and Shippen was biased by his intimacy with the latter; for, so far as is known, Morgan had not been favored by his close friendship during his residence in London.

Whatever may have been the feeling between the two young Philadelphians at this time, Morgan interested himself actively in Shippen's candidacy for the chair of anatomy and surgery in the proposed school; but Shippen's letter of application clearly denotes pique:

> To the Trustees of the College, etc.:
>
> The institution of Medical Schools in this country has been a favorite object of my attention for seven years past, and it is three years since I proposed the expediency and practibility of teaching medicine in all its branches in this city in a public oration read at the State House, introductory to my first course of Anatomy.
>
> I should long since have sought the patronage of the Trustees of the College, but waited to be joined by Dr. Morgan, to whom I first communicated my plan in England, and who promised to unite with me in every scheme we might think necessary for the execution of so important a point. I am pleased, however, to hear that you gentlemen, on being applied to by Dr. Morgan, have appointed that gentleman Professor of Medicine. A Professorship of Anatomy and Surgery will be accepted by, gent.,
>
> Your most obedient and
> very humble servant,
> William Shippen, Jr.
>
> Philadelphia, 17th September, 1765.

Certainly this communication was most direct and unequivocal. So strong was Shippen's position that he clearly dictated his terms. Nor has any record been found of a challenge of Shippen's accuracy in this statement by Morgan or any other interested party. Accordingly it must be assumed either that its essential truth was accepted by his contemporaries, or that in the interest of harmony his inferred charges of disaffection were ignored.

As a matter of fact the remarks in Shippen's introductory lecture delivered in the State House in 1762 which might be considered as a proposal of such an institution, were most general.

> All these [disadvantages] may, and I hope will soon be remedied by a medical school in America; and what place in America is so fit for such a school as Philadelphia, that bids so fair by its rapid growth to be soon the metropolis of all the continent? Such a school is properly begun by an anatomical class, and for our encouragement, let us remember that the famous school of physic at Edinburg, which is now the first in Europe, has not had a beginning fifty years, and was begun by the anatomical lectures of Dr. Monro, who is still living.

In Morgan's Discourse no whit of credit was denied Shippen for his pioneer work in the teaching of anatomy; but the most cursory study of this document will convince its reader of the more profound grasp of Morgan in the matter of medical education. Particular attention is directed to his statement that:

> I was further induced to it from a consideration that private schemes of propagating knowledge are unstable in their nature, and the cultivation of useful learning can only be effectually promoted under those who are patrons of science, and under the authority and direction of

men incorporated for the improvement of literature.

Further documentary evidence pertaining to this question might be advanced, but enough has been quoted to establish the widely divergent aims of the two young physicians so deeply interested in the establishment of medical education in America. Certainly, from the present viewpoint Morgan alone had a clear conception of the problem and a logical solution for the same. However, Shippen's success as a private teacher of anatomy in Philadelphia was established, and his support in the new project was not only desirable but absolutely essential to its very existence. The relationship hereby created between the calm self-possessed Shippen and the positive, impulsive Morgan was to pass through every degree of intimacy to ultimate hatred.

However, the Medical School of the College of Philadelphia announced its first session in the *Pennsylvania Gazette* of September 26, 1765, as follows:

> As the necessity of cultivating medical knowledge in America is allowed by all, it is with pleasure we inform the public that a Course of Lectures on two of the most important branches of that useful science, viz., Anatomy and Materia Medica, will be delivered this winter in Philadelphia. We have great reason, therefore, to hope that gentlemen of the Faculty will encourage the design by recommending it to their pupils, that pupils themselves will be glad of such an opportunity of improvement, and that the public will think it an object worthy their attention and patronage.
>
> In order to render these courses the more extensively useful, we intend to introduce into them as much of the Theory and Practice of Physic, of Pharmacy, Chemistry, and Surgery as can be conveniently admitted. From all this, together with an attendance on the practice of the physicians and surgeons of the Pennsylvania Hospital, the students will be able to prosecute their studies with such advantage as will qualify them to practice hereafter with more satisfaction to themselves and benefit to the community.
>
> The particular advertisements inserted below specify the time when these lectures are to commence, and contain the various subjects to be treated of in each course, and the terms on which pupils are to be admitted.
>
> William Shippen, Jr., M.D.,
> Professor of Anatomy and Surgery in the College of Philadelphia
> John Morgan, M.D. F.R.S., Etc.,
> Professor of Medicine in the College of Philadelphia.

Then followed the announcements of the separate courses. The work under Shippen was advertised thus:

> Dr. Shippen's course of Anatomical Lectures will begin on Thursday, the 14th of November, 1765. It will consist of sixty lectures, in which the situation, figure, and structure of all the Parts of the Human Body will be demonstrated on the fresh subject; their respective uses explained, and their Diseases, with the Indications and Methods of Cure, briefly treated of; all the necessary Operations in Surgery will be performed, a Course of Bandages given, and the whole will conclude with a few plain and general directions in the Practice of Midwifery. Each person to pay six Pistoles.
>
> Those who incline to attend the Pennsylvania Hospital and have the Benefit of the curious anatomical Plates and Casts there, to pay six pistoles to that useful Charity.

Shippen's reputation as a teacher grew apace. It was his custom to review his previous lecture by interrogation rather than by reiteration. His happy manner enabled him so to blend a delicate irony with good

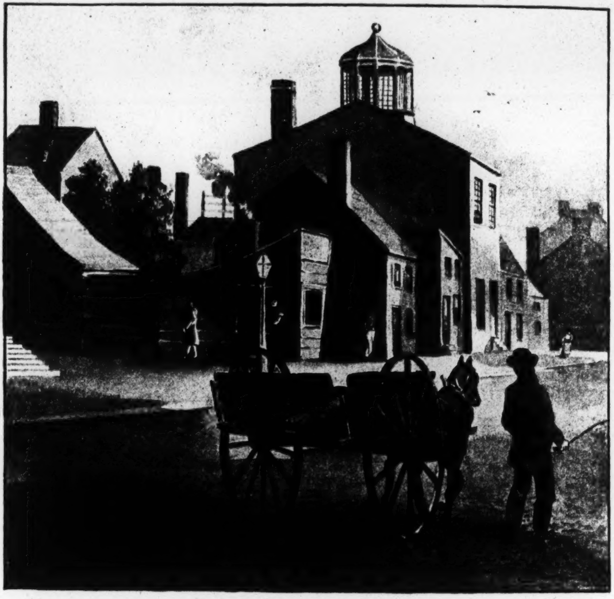


FIG. 6. ANATOMICAL HALL.

humor as to "repress forwardness, and take notice of negligence, so as to admonish the spectators, without too much exposing the defaulter." One of his students, Charles Caldwell, affords one of the most vivid pictures of Shippen's manner and method of teaching in an Eulogy of his former professor. His eloquence appealed to understanding rather than to passion and was demonstrative rather than persuasive:

> It was calm, dignified and luminous; flowing with the majesty of a spacious stream, sweeping unbroken through a level country; not hurrying along with the irregular force and wild impetuosity of a mountain torrent. It consisted in a rich and perspicuous arrangement of facts, accompanied by fair and forcible inductions, clothed in choice and appropriate language, and delivered in a manner the most graceful and impressive.

Reverting to his earlier reactions as a student under Shippen, Caldwell draws a much less glowing picture in his "Autobiography," which, it will be recalled, Osler charged to be "A storehouse of facts (and fancies) . . . pickled in vinegar":

> Though Dr. Shippen, who, in stature and figure, countenance, and general appearance, and style of manners, was one of the most elegant and gentlemanly personages of the time; and though possessed of an excellent and well-cultivated mind, he was a polished, and, when excited, an impressive, if not an eloquent public speaker; yet was he far from being accomplished in the art of reading. And having previously written his lecture, he read it, from a manuscript before him, in a dull, cold, and monotonous manner.

Even less charitable was the assumption that Shippen had taken his introductory lecture in toto from his master, William Hunter.

Charles Caldwell has preserved one characteristic episode from his personal contact with Shippen which mellows the hypercritical analysis of his "Autobiography." On the occasion of Caldwell's doctorate examination:

> Dr. Shippen, who was somewhat inclined to what is termed fun, and innocent mischief, having heard me reported as the best linguist in the class, and suspecting, perhaps, that I valued myself on that school-boy attainment, transferred his duty on the occasion to Dr. Wistar, in order, as he good-naturedly and playfully said, that he [Dr. Wistar] and myself might talk to each other in Latin, like the Younger and Elder Pliny, and afford him an opportunity of judging which of us was best entitled to be proud of his scholarship.

Wistar and Caldwell accepted the challenge and upon completing the entire examination in Latin "were highly complimented on our scholarship by the venerable professor."

Manuscript notes of one of Shippen's students in 1783–4 are preserved in the Library of the University of Pennsylvania. Either the professor or the student was extremely brief and only a very nebulous framework of the several subjects is gathered from this source. The frequent references to Monro, Hunter, Douglas, Cheselden and other accepted authorities bespeak the lecturer's familiarity with the literature and standard texts. A few interesting notes are appended:

> Blood is red more or less from its degree of motion; hence the arterial exceeds the venous blood.
>
> The farther arteries proceed from their source, they go off at more acute angles.
>
> The humours that are secret'd by the different glands are divid'd in four classes, viz. 1st all the viscid and lymphatic juices, 2nd all exhalates and perspirable matter, and some inhalable. 3rd all viscid, sluggish and ropy juices. 4th all inflammable juices, which are at first thin, but by standing become thick and oftentimes bitter.
>
> January 14th Shew'd us the Contents of the Abdomen and Thorax, a second time in situ naturali, repeating many observations necessary to be remember'd as before.

The notes on surgery are even more remarkable by reason of the range of subjects covered in a single lecture. The following constitute the complete notes for the stated dates:

> Feb. 17th—sutures, gastroraphy. Tracheo-tony [*sic*], Empyema, and the hair [*sic*] lip were explained.
>
> Feb. 18th Fistula lachrymalis, Couching, extracting Polypus from the nose & Extirpation of the Tonsils.
>
> Feb. 19th Phymosis, Paraphymosis, Hernias, Hydrocele, Castration and Paracentesis.
>
> Dr. Shippen related two cases of great dropsical cistension [*sic*] reliev'd by the application of oil rubb'd well on the part, and warm.

The concluding note of the medical student in his surgical course is illuminating: "Nothing particular in these lectures presents the necessity of further annotations."

On Shippen's return to Philadelphia he found obstetrics in poor repute as a specialized form of medical practice. His conviction of the profession's responsibility in this direction found an able second in the person of John Redman, who ranked as one of the best accoucheurs in the colonies. Then, too, Spencer in 1745 and Thompson in 1748 had brought the practice of obstetrics to a higher plane in Philadelphia than elsewhere in America. Accordingly when Shippen announced his course in March, 1762, the soil had been somewhat prepared for the first systematic teaching of midwifery in the colonies.

> Doctor Shippen, Junior,
>
> Proposes to begin his first course on Midwifery as soon as a number of pupils sufficient to defray the necessary expenses shall apply. A course will consist of about twenty lectures, in which he will treat of that part of anatomy which is necessary to understand that branch, explain all cases in midwifery—natural, difficult, and preternatural—and give directions how to treat them with safety to the mother and child; describe the diseases incident to women and children in the month, and direct to proper remedies; will take occasion during the course to explain and apply those curious anatomical plates and casts of the gravid uterus at the Hospital, and conclude the whole with necessary cautions against the dangerous and cruel use of instruments.
>
> In order to make the course more perfect, a convenient lodging is provided for the accommodation of a few poor women, who otherwise might suffer for want of the common necessaries on these occasions, to be under the care of a sober, honest matron, well acquainted with lying in women, employed by the Doctor for that purpose. Each pupil to attend two courses at least, for which he is to pay five guineas. Perpetual pupils to pay ten guineas.
>
> The female pupils to be taught privately, and assisted at any of their private labors when necessary. The Doctor may be spoke with at his house, in Front Street, every morning between the hours of six and nine; or at his office in Letitia Court every evening.

After the war this instruction was given in the general course rather than to separate private classes. The sole reporter to whom access has been possible, was obviously impressed by the "excellent admonitions with respect to the Deportment of an Accocheur [*sic*]." Certain further notes are worthy of preservation:

> Tho' many Symptoms indicate conception and Proximity of Parturition, yet none is equal to the act of Touching. The best Position for that purpose is an erect one with the body bent forward supported by a chair, when the finger must be introduced from behind, observing to incline it towards the sacrum as the ostincea points that way.

Shippen advised close paring of the nails and greasing of the hands in preparation for delivery. Conservatism was his watchword. "Real labor pains should never be encourag'd before the 7th month with't a blooding should come on." Mouth to mouth insufflation was his preferred method of resuscitation.

June 21, 1768 is a memorable date not only in the history of the young medical school in Philadelphia, but also in America; for on that date the degree of Bachelor of Medicine was conferred upon eight successful candidates. Hence it may well be termed the "Birthday of Medical Honors in America." Shippen delivered the charge to the medical graduates inviting them

> . . . to support the dignity of their Profession by a laudable perseverance in their studies, and by a Practice becoming the character of gentlemen; adding many useful precepts respecting their conduct towards their patients, charity towards the poor, humanity towards all; and with reference to the opportunities they might have of gaining the confidence of the sick, and esteem of every one who by their vigilance and skill might be relieved from suffering and restored to health.

The path of this early teacher of anatomy in Philadelphia was beset with the same obstacles to the procural of bodies for dissection which were current throughout the world. On several occasions his anatomical laboratory was stoned and its windows shattered. Again his person was threatened; and indeed while he was making his escape by another route, his carriage standing before the door was showered with stones and a musket ball passed through its center. Apparently transients rather than citizens of Philadelphia were responsible for these demonstrations, since this particular violence came to be known as the Sailors' Mob. The tact of Shippen and the intervention of influential Philadelphians surmounted this serious crisis. So precarious was the situation, however, that the following notice was published in the *Pennsylvania Gazette* of October 31, 1765:

> It has given Dr. Shippen much pain to hear that notwithstanding all the caution and care he has taken to preserve the utmost decency in opening and dissecting dead bodies, which he has persevered in chiefly from the motive of being useful to mankind, some evil-minded persons, either wantonly or maliciously, have reported to his disadvantage that he has taken up some persons who are buried in the Church Burying Ground, which has distressed the minds of his worthy Fellow Citizens. The Doctor, with much pleasure, improves this opportunity to declare that the Report is absolutely false, and to assure them that the bodies he dissected were either of persons who had wilfully murdered themselves, or were publickly executed, except now and then one from Potter's Field, whose death was owing to some particular disease, and that he never had one body from the church or any private Burial Place.

Isolated instances of the disposition of the bodies of suicides and executed criminals in this manner, noted by the public press of the day, corroborate Shippen's statement in the main and Norris calls attention to the fact that at times the bodies of criminals from adjoining colonies were sent to him for dissection; but the admission of an occasional intrusion upon the potter's field might well have been damaging.

Shippen conducted his courses in anatomy in a building erected by private funds in the rear of his father's home in Fourth Street. It was approached by an alley running north from Market Street. With the establishment of the Medical School in 1765 came improved physical facilities. Certain of the courses were given in the College which occupied the New Building constructed by general subscription in 1740, as a fitting nonsectarian meeting-place for Whitefield, and such revivalists as might later visit Philadelphia. This building was located on the west side of Fourth Street just below Arch. Whitefield had preached in it twice a day for over a week in 1740, although the roof had not yet been completed. He described its proportions and purposes in a letter:

> I was pleasingly surprised at the sight of it. It is one hundred feet long and seventy feet wide and now just ready to be covered. As I am chosen one of the Trustees and have promised to procure a master and mistress for the first scholars, I think it my duty to make what interest I can towards carrying on so good a work. The house is intended for public worship and a charity school.

Occupied in turn by various sectarian and non-sectarian groups it came finally through the offices of Benjamin Franklin to house the first school for higher education in Philadelphia, the Academy and later the College of Philadelphia. Anatomical Hall, or Surgeons' Hall as it was often termed, accommodated Shippen's classes from 1765 to 1806 according to some sources, whereas others state that he utilized his private quarters for a time following the institution of the Medical School. During the period of his service as a teacher his classes mounted from 12 to 250; but the years of greatest educational growth were from 1769 to 1775. The addition of Thomas Bond, Adam Kuhn and Benjamin Rush to the faculty lent an impetus to the young medical school which was to carry it triumphantly if not peacefully over the soul-trying Revolutionary period. Shippen conducted his courses regularly except for the winters of 1776 and 1777; but the other years of the Revolution saw the teaching greatly abbreviated.

[*To Be Concluded*]

THE ORIGIN OF THE MALE MIDWIFE

By WILLIAM F. MENGERT, M.D.

PHILADELPHIA

THE history of the man midwife prior to the invention of the obstetric forceps is essentially the history of obstetrics. Of the early period little is known. It is highly probable, however, that from the birth of the art (which really means from the origin of man) obstetrics had been in the hands of women. Here and there, we find an occasional man who became interested in parturition, but never until comparatively recent years has the practice of obstetrics interested men to any extent. Engelmann in his classic book, "Labor Among Primitive Peoples," shows that primitive women still preside at the labors of their pregnant sisters. Though occasionally a man, the husband, or any husky young male, may be called in to help, it is merely acquiescence to demand, with no attempt whatsoever to usurp the time-honored rights of women to "stand before" (*obstare*).

Margaret Mead in her two books, "Coming of Age in Samoa," and "Growing Up in New Guinea," advances the interesting fact that among these primitive peoples the pregnant woman is taboo to all but her female relatives, further evidence of the absolute dominion of women in matters relating to childbirth.

What is true among primitive peoples in our times is at least suggestive of what may have been true in prehistoric times. We may infer then, that the management of labor was considered women's work, and men in general did not meddle except on invitation. There have been, however, a few courageous souls who have struggled against severe criticism and ridicule to obtain a knowledge of the art of midwifery only to have their collected knowledge die with them, or at most be left behind in forgotten and musty tomes. Occasionally such a man paid dearly for his desires for obstetrical knowledge. Dr. Viles of Hamburg, Germany, was publicly branded for having attended a woman in labor, himself disguised as a woman. Another writer says that he was condemned to the flames.

Perhaps even today the medical practice of midwifery seems less distinguished than some of the other specialties because it was originally wrested from the hands of women, and for centuries was considered an inappropriate occupation for men.

It is doubtful if the complete reversal of custom which put men in the commanding position in obstetrics would have taken place had it not been for the invention of that "noble and beneficent instrument, rescuing more lives and cutting short more pains than all the other instruments in the professional armamentarium," the obstetric forceps. Without this invention most surely the practice of obstetrics would still be in the hands of women. Undoubtedly some men would be working side by side with them, but the obstetrician of today would be unknown.

The story of this revolution that took midwifery out of the hands of woman and placed it in the hands of man, the "male-midwife," the "accoucheur," the "obstetrician," becomes then, first the sporadic appearance of those individuals down through the ages who advanced the art of obstetrics, and second, the story of those men who saw the opportunity offered by such a means of delivery as the obstetric forceps, embraced it, and withstood the diatribes, the polemics, the maliciousness of the midwife who saw her means of livelihood slipping away, and the attacks of those religious fanatics, who directed their prudish writings to societies for the suppression of vice.

Curiously enough, though woman has held the practice of obstetrics in her hand for ages while the obstetrician is practically a product of the twentieth and of the last half of the nineteenth centuries, the advances in obstetrics are largely due to man.

Among the 640 cultural objects listed in Sudhoff's Dresden Catalogue (1911) is the portrayal of an Egyptian queen in labor on an obstetric chair attended by four midwives (18th dynasty, *c.* 1350 B.C.). The Bible contains many records of labor attended by midwives. A classical reference is found in Genesis 35, 16–17: "And Rachel travailed, and she had hard labor. And it came to pass, when she was in hard labor, that the midwife said unto her, 'Fear not, thou shalt have this son also.'" Moses, the Jewish legislator, who lived one thousand years before Hippocrates, speaks of the midwives as a respectable and distinct group among the Hebrews. In the first chapter of Exodus we find the King of Egypt telling two Hebrew midwives, Shiphrah and Puah: "When ye do the office of a midwife to the Hebrew women and see them upon the stools, if it be a son then ye shall kill him." When these midwives did not obey the royal command and were recalled to give an accounting, their excuse was (Ex. 1, 19): "Because the Hebrew women are not as the Egyptian women; for they are lively, and are delivered ere the midwives come in unto them."

Midwives in Greece apparently were held in high esteem from the frequent allusions to them and their duties in the works of Hippocrates, Plato, Aristotle and others. Phanarette, the mother of Socrates, was a midwife.

Occasionally in times of direst need, men were called in to give aid. Naturally it was the surgeon who was called. However, when one thinks that these men did not have the opportunity of observing the course of normal labor, and so had no knowledge of it, one realizes that their obstetrical practice was entirely theoretical. For this reason it is doubtful if so great a man as Hippocrates, 460 B.C., had much real knowledge of obstetrics, and it is not at all certain that writings on the subject accredited to him are genuine. However, there are many procedures said to be his, particularly in operative obstetrics; for instance embryotomy, and the use of the crochet. In difficult and tedious labors the patient was to be shaken by two assistants until the child was expelled. Engelmann reports this method of treatment of difficult labor among the American Indians during the latter part of the last century.

Another male attaining renown in midwifery was Celsus, the Roman (*c.* 100 A.D.). Probably his greatest contribution to obstetrics was the declaration that podalic version was not a difficult operation, and his many valuable hints as to the most effective means of doing it. He devised an efficient, if crude, instrument for decapitation, but his desire to hasten the delivery of the placenta stands in contrast to the ideas credited to Hippocrates on the subject.

Soranus of Ephesus (2nd century A.D.), a follower of the Methodist school of Asclepiades, was one of the leading authorities of antiquity on gynecology, obstetrics and pediatrics. His treatise on midwifery and the diseases of women was the original of Rösslin's "Rosengarten" (1513) and Raynalde's "Byrthe of Mankynde" (1545). Many of the supposed innovations in these books, such as the obstetric chair and podalic version, have been traced back to Soranus.

Paul of Aegina (625–690 A.D.) was the last, and perhaps the best known, of the Byzantine physicians. He was a product of the Alexandrian school, which had always maintained its reputation for anatomy and surgery, and Paul became especially eminent in surgery and midwifery. The Pauline pediatrics and obstetrics summarized all that was known of these subjects and were authoritative until the Renaissance. Paul omits all reference to podalic version, and as his teachings were followed by the Arabians, the procedure disappears from the literature until Rösslin, basing his book on the writings of Soranus, mentioned it, and Paré, half a century later, performed it. Paul's reputation was so great that the Arab midwives used to summon his assistance, although ordinarily the Arabs did not allow men to preside at accouchements.

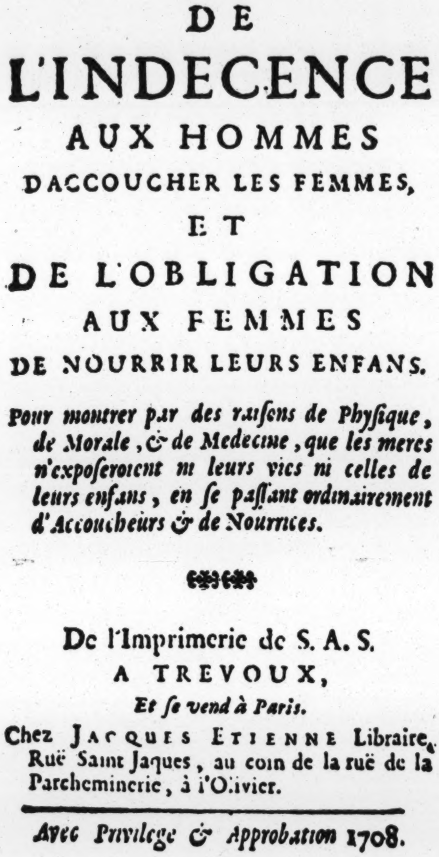
From this time on there were no real additions to obstetrics until the time of Paré, though Abulkasim (called Albucasis), the Arabian (1013–1106), attained some note in obstetrics and mentioned the obstetrical posture known today as the "Walcher position."

So, the appearance of great names in obstetrics before the invention of the obstetric forceps was a sporadic and desultory affair, and the conduct of normal labor, and indeed of preternatural labors, remained where it had always been, in the hands of women.

Obstetrics profited along with the general revival of interest in learning attending the Renaissance, and in 1513 there appeared at Worms the "Rosengarten" of Eucharius Rösslin, a work which bears about the same relation to Renaissance obstetrics that the "Anathomia" (published 1487) of Mundinus (*c.* 1275–1290) does to medieval anatomy. Although it is mainly a compilation from the works of Soranus of Ephesus, it was the first printed textbook in the field. The three first editions, issued simultaneously, were interesting for their quaint cuts, for the inclusion of podalic version as described by Soranus, and for the fact that the text was miserably plagiarized by Walther Reiff in 1545 (not to be confused with Jacob Rueff, the first man to invent a forceps with the declared intention of delivering a living child). Later the book was translated and reissued by William Raynalde as "The Byrthe of Mankynde" (London, 1545).

Ambroise Paré (1510–90), the incomparable, although a surgeon in the highest sense of the word, made the procedure of podalic version viable and practicable, and also had the courage to induce artificial labor in cases of uterine hemorrhage.

Until the time of the invention of the obstetric forceps there was no known way of obtaining a living child in cases of difficult labor except by podalic version. Why men did not think of such an instrument before is a mystery. Currier, in Stedman's "Reference Handbook of the Medical Sciences" (quoted by Das) says:



DE
L'INDECENCE
AUX HOMMES
D'ACCOUCHER LES FEMMES,
ET
DE L'OBLIGATION
AUX FEMMES
DE NOURRIR LEURS ENFANS.

Pour montrer par des raiſons de Phyſique, de Morale, & de Medecine, que les meres n'expoſeroient ni leurs vies ni celles de leurs enfans, en ſe paſſant ordinairement d'Accoucheurs & de Nourrices.

De l'Imprimerie de S. A. S.
A TREVOUX,
Et ſe vend à Paris.
Chez JACQUES ETIENNE Libraire, Ruë Saint Jaques, au coin de la ruë de la Parcheminerie, à l'Olivier.

Avec Privilege & Approbation 1708.

FIG. 1.

Parturition is the most natural thing in the world and when the conditions which surround it are natural, midwives and obstetricians are superfluous and may be regarded in the light of luxuries. But there is no physiological function of which there are no deviations from the normal. Man and animal are occasionally in a hopeless situation with regard to the function of parturition, and it then becomes simply impossible of accomplishment without the assistance of art and human intelligence. Hence arose the necessity for some sort of a contrivance which should serve as an extension of the hands of the midwife, which should grasp and extract the living being—without killing or maiming it.

All the instruments, and they were many, invented in antiquity, of necessity killed the child in order to extract it, *vide* hooks, crochets, embryotomes, knives, etc.

Rueff of Zurich (1554) invented the "Forceps longa et tersa" which possessed in an underdeveloped form the essential characters of the modern instrument. This was the first expression of inoffensive and conservative instruments designed to effect delivery. However, it is evident that his forceps was insufficient for practical use for it was only 14 cm. long, and the blades were riveted together. Ingerslev states: "Perhaps it was used for removing stones from the bladder."

Some mystery still surrounds the invention of the obstetric forceps as we know it today. That it was devised by a member of the famous Chamberlen family, who kept the knowledge of the instrument in the family and a secret from the world for over a hundred years, is well known. The best available evidence gives the honor to Peter Chamberlen, senior, who probably invented the forceps in 1600, and possibly a few years earlier. It did not, however, become general knowledge until the end of the first trimester of the eighteenth century, about 1733, and it was not until William Smellie laid down the rules for its use that the instrument became generally accepted.

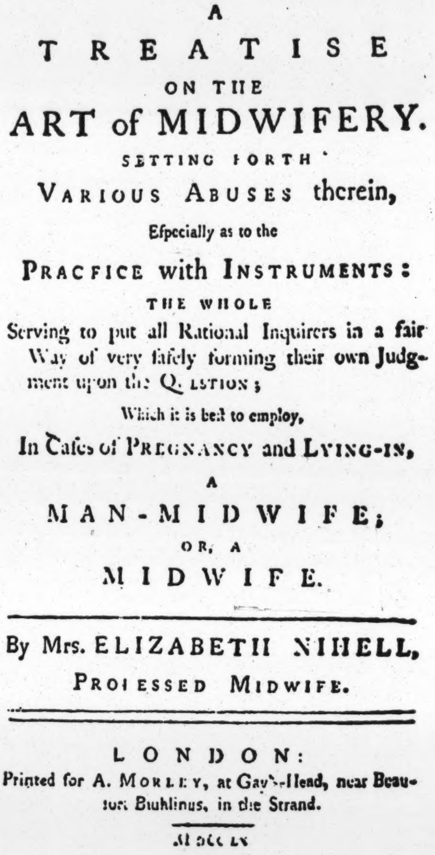
Male midwifery, however, had already begun to have a few practitioners. Peter Chamberlen, son of Peter the younger, attended Queen Henrietta Maria, wife of Charles I of England, in 1682 when the royal patient had a miscarriage, and in 1692 Hugh Chamberlen, senior, his son, assisted at the birth of the future Queen Anne.

In France, le sieur Boucher attended La Vallière, mistress of Louis XIV in her first confinement in 1663 and in 1670 Julien Clement attended Madame de Montespan at the birth of the Duc de Maine. Afterwards he delivered the Dauphine (1682) and received the title of "Accoucheur." Male midwifery soon became the fashion among the great ladies of the court. François Mauriceau in 1668 published a work, the result of his large experience, which revolutionized old ideas and established obstetrics as a science. Progress in this matter, male midwifery, was, however, slow and when a certain obstetrician told Joseph II of Austria (1741–90) that the Viennese women were too modest to have men deliver them, he replied with fitting irony: "Would they were not modest to that extent."

At first the obstetrician simply supervised or assisted at the conduct of labor of those who could afford his services, but as soon as women began to permit physicians to examine the parts as well as deliver them, inductive knowledge began to make rapid strides.

The history of the male midwife from here on (*c.* 1733) is not in any sense a history of obstetrics, but is rather a story of the strife between the opponents and proponents of the accoucheur.

Partly as a result of the secrecy attending the obstetric forceps, partly in consequence of their self sufficient and combative characters, and finally as a result of the knowledge that by means of this instrument they could deliver women without injury to mother or child, the Chamberlens were very successful in practice. Conversely, it was ignorance of the forceps which partly explained and justified the opposition of the midwives to the male practitioners.



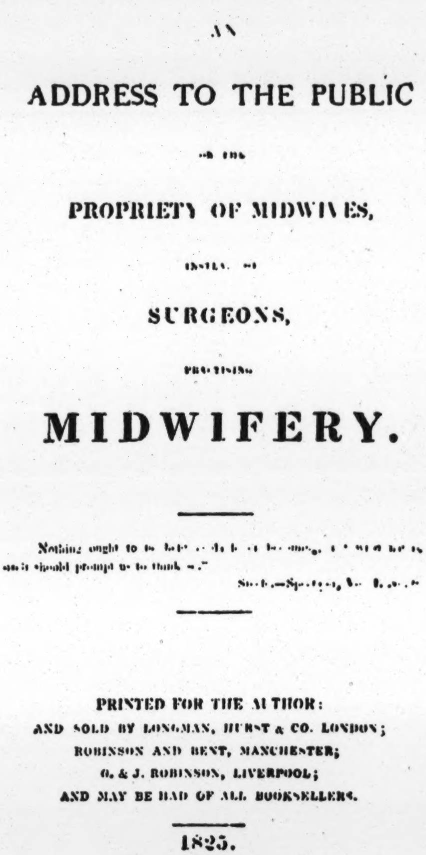
A
TREATISE
ON THE
ART of MIDWIFERY.
SETTING FORTH
VARIOUS ABUSES therein,
Eſpecially as to the
PRACTICE with INSTRUMENTS:
THE WHOLE
Serving to put all Rational Inquirers in a fair
Way of very ſafely forming their own Judgment upon the QUESTION;
Which it is beſt to employ,
In Caſes of PREGNANCY and LYING-IN,
A
MAN-MIDWIFE;
OR, A
MIDWIFE.

By Mrs. ELIZABETH NIHELL,
PROFESSED MIDWIFE.

LONDON:
Printed for A. MORLEY, at Gay's-Head, near Beaufort Buildings, in the Strand.
MDCCLX

FIG. 2.

As a result of the increasing popularity of the male midwife, there began to appear a whole series of controversial articles written by midwives, who viewed the inroads on their practice with real concern and alarm, or by men, many of them doctors, whose sense of propriety was enormously outraged at the interference of men with the order of things established by the custom of ages. The controversy raged almost unabated for nearly a century. In America it persisted even longer, in fact practically until the close of the nineteenth century.



AN

ADDRESS TO THE PUBLIC

[illegible]

PROPRIETY OF MIDWIVES,

[illegible]

SURGEONS,

[illegible]

MIDWIFERY.

"Nothing ought to be [illegible]
[illegible] should prompt us to think [illegible]."
[illegible]

PRINTED FOR THE AUTHOR:
AND SOLD BY LONGMAN, HURST & CO. LONDON;
ROBINSON AND BENT, MANCHESTER;
G. & J. ROBINSON, LIVERPOOL;
AND MAY BE HAD OF ALL BOOKSELLERS.

1825.

FIG. 3. "PROPRIETAS."

One of the first of these pamphlets, some hundred pages in length, was written by Hecquet in France and published in 1708. A second edition appeared in 1744. Unfortunately Hecquet's name does not appear on the title-page which is reproduced here (Fig. 1).

On the continent the pioneers in male midwifery were: Paris, Baudelocque (1746–1810), and Levret (1703–80); Amsterdam, Camper (1722–89); Vienna, Boër (1751–1835); and Copenhagen, Saxtorph. In London the most famous name is that of William Smellie (1697–1763), and in Dublin, Sir Fielding Ould (1710–1789).

William Smellie was the storm center about which the controversy raged. When one considers the place of this famous obstetrician, probably the most famous of all time in the art of midwifery, it is natural that he should have been the target for the various attacks. Born in Lanarkshire, a poor Scottish lad, he practiced general medicine in Lanark, became interested in obstetrics, and later, dissatisfied with the crude practice of the times, repaired to London on his own initiative. Not finding there what he was seeking, he continued on to Paris only to be disappointed again. Later he returned to London and began to practice and teach obstetrics. Smellie says of his Paris experience, "Though his [Gregoire's] method might be useful to a young beginner, his machine was no other than a piece of basket work containing a real pelvis covered with black leather upon which he could not clearly explain the difficulties that occur in turning children." Although the obstetric forceps was general knowledge at this time, the instrument was still crude; there were no rules and indications regarding its use, and there had been many failures in attempts to deliver patients by this means. Most notable of all was the failure of Hugh Chamberlen, senior, in 1670, to deliver a rachitic dwarf referred to him by Mauriceau, who said of the patient:

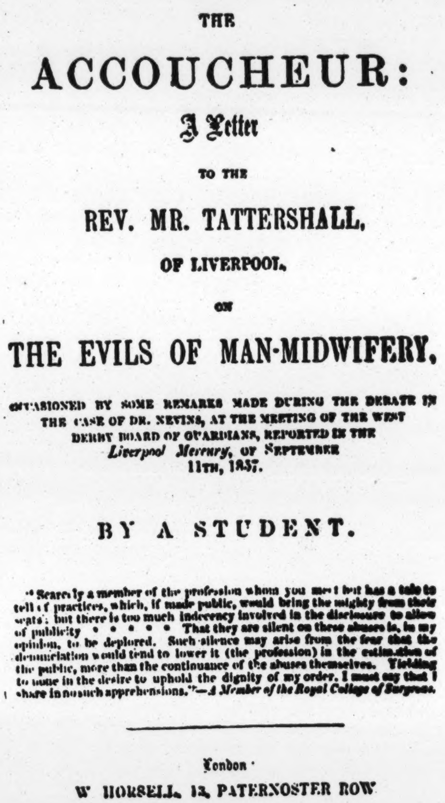
> For this woman was so small, and the bones [of the pelvis] so narrow and close to each other, and the sacrum so curved forwards, that it was quite impossible to introduce the hand to deliver her,

although mine is small enough—or to introduce the fingers sufficient to enable me to use a crochet safely, so as to extract the child which had been apparently dead for about four days.

The first accurate description of the pelvis and its deformities and the effect of the latter in complicating labor was given by the Dutchman, Van Deventer (1651–1724). But it was William Smellie who was the student of normal labor, and who in consequence was able to lay down such correct rules for the use of the forceps that his principles are today as sound as when he enunciated them. His teachings served to revive interest in a somewhat waning use of the instrument, and it followed quite naturally that he was attacked by the opponents of the male midwife. His most bitter critic was Wm. Douglas, M.D., who wrote "A Letter to Dr. Smellie [*sic*] shewing the Impropriety of his New Invented Wooden Forceps; as also The Absurdity of his Method of Teaching and Practising Midwifery."

It was inevitable that the best known London midwife of the day, Mrs. Elizabeth Nihell, who had studied in Paris, should take up cudgels against Smellie. She referred to Smellie's hands, which unquestionably were large, as "the delicate fist of a great-horse-godmother of a he-midwife." Her book, written in 1760, has a formidable titlepage (Fig. 2). The keynote of the book is:

> I own, however, there are but too few midwives who are sufficiently mistresses in their profession. In this there are some of them but too near upon a level with the man-midwives, with this difference, however, in favour of the female practitioners, that they are incapable of doing so much actual mischief as the male ones, oftenest more ignorant than themselves, but who with less tenderness and more rashness go to work with their instruments.



THE

ACCOUCHEUR:

A Letter

TO THE

REV. MR. TATTERSHALL,

OF LIVERPOOL,

ON

THE EVILS OF MAN-MIDWIFERY,

OCCASIONED BY SOME REMARKS MADE DURING THE DEBATE IN
THE CASE OF DR. NEVINS, AT THE MEETING OF THE WEST
DERBY BOARD OF GUARDIANS, REPORTED IN THE
Liverpool Mercury, OF SEPTEMBER
11TH, 1857.

BY A STUDENT.

"Scarcely a member of the profession whom you meet but has a tale to tell of practices, which, if made public, would bring the mighty from their seats; but there is too much indecency involved in the disclosure to allow of publicity * * * * * That they are silent on these abuses is, in my opinion, to be deplored. Such silence may arise from the fear that the denunciation would tend to lower it (the profession) in the estimation of the public, more than the continuance of the abuses themselves. Yielding to none in the desire to uphold the dignity of my order, I must say that I share in no such apprehensions."—*A Member of the Royal College of Surgeons.*

London

W. HORSELL, 13, PATERNOSTER ROW

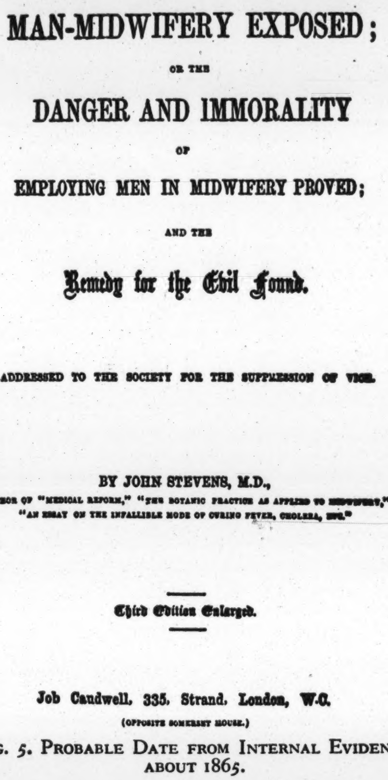
FIG. 4.

She rings the charges upon this theme in the four hundred odd pages that comprise the work. The term "man midwife" raises her ire. It is as incongruous, she declares, to speak of a man-midwife as a "woman-coachman."

Another critic of William Smellie was Dr. John Blunt, some quotations from whose book, "Man Midwifery Dissected," follow.

> You remember sir, it was the rule with the late Dr. Smellie to have his pupils present at the delivery of his poor hospital patients, and also of poor women at their own dwellings. The following are

his own words, "In the series of courses, one thousand one hundred and fifty women have been delivered in the presence of those who attended me, over and above those difficult cases to which we are often called by midwives." Now we will enquire how Dr. Smellie and his swarms of male pupils that attended his experiments together, were employed; and for this purpose I shall also quote Dr. S.' own words, "In the year 1749, I with my pupils, attended one of our women in Drury Lane. But we were all mistaken as to the position of the head, for I as well as my pupils, imagined that the head was so low, etc. . . . I had her put in the same position, and applied the forceps in the same manner as in the afore-mentioned case. I then pulled very gently every pain, and the woman being exposed to show the operation, I was surprised to see what I imagined the occiput come along with the pubes, etc." Oh, modest Dr. Smellie! He first permitted the students to examine the patient, and then uncovered her during the operation with the forceps, that they *all* might see the child's entrance into the world. I will quote another case or two: "A woman in the year 1750 bespoke me to attend her. I had the patient laid supine across the bed and her legs supported by two of my pupils . . . " Would husbands suffer this if they were present? Imagine forty or fifty gay fellows, full of midnight sprees, and half-and-half surrounding the patient with those sacred parts of her person all exposed to their indecent gaze! Bright and peering is the eyeglass of the dissipated fop, insinuating is the gross jeer of the medical libertine, the habitual scoffer at all human virtue.



MAN-MIDWIFERY EXPOSED;

OR THE

DANGER AND IMMORALITY

OF

EMPLOYING MEN IN MIDWIFERY PROVED;

AND THE

Remedy for the Evil Found.

ADDRESSED TO THE SOCIETY FOR THE SUPPRESSION OF VICE.

BY JOHN STEVENS, M.D.,

AUTHOR OF "MEDICAL REFORM," "THE BOTANIC PRACTICE AS APPLIED TO MIDWIFERY,"

"AN ESSAY ON THE INFALLIBLE MODE OF CURING FEVER, CHOLERA, ETC."

Third Edition Enlarged.

Job Caudwell, 335, Strand, London, W.C.

(OPPOSITE SOMERSET HOUSE.)

FIG. 5. PROBABLE DATE FROM INTERNAL EVIDENCE, ABOUT 1865.

Concerning vaginal examination, Dr. Blunt has the following to say:

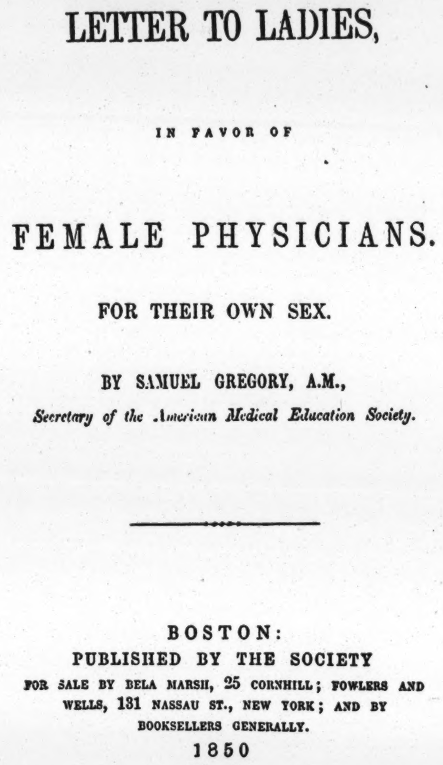
> What do you think, sir, of the *decency* of a *touching* lecture? Is it proper to convene a number of pregnant women, for the purpose of being examined, all round by each pupil, in a standing posture, both on the abdomen and per vagina? Are not these women treated with less decency than a farmer would treat his horse or his cow, who wished to examine if they carried young? Pray, sir, what is the use of this said touching? Why, it is designed to qualify *men* to inform *modest* women, whose usual system is a little deranged, to say whether they are breeding or not, and how far gone. I say, it is for the purpose of qualifying these boys to satisfy the curiosity of women, *alias* female brutes, who are sufficiently fashionable to be beyond the reach of vulgar censure, and who have stoically forgotten to blush, unless it be by the assistance of rouge—women who trample on the laws of decorum, and under the protection of matrimony, stare chastity out of countenance . . . Touching is performed by introducing the forefinger, lubricated with pomatum, into the vagina, in order to feel the os internum and the

neck of the uterus: and sometimes into the rectum, by discovering the streck of the fundus. The design of touching is to be informed whether the woman is or is not with child; to know how far she is advanced in her pregnancy; if she is in danger of miscarriage of the os internum and the pressing down of the membranes with their waters; and lastly, to distinguish what part of the child is presented . . . Now imagine an apothecary's lad doing this! A young creature is but a few months married, and feels a little unwell, before a stranger is sent for: asking a few questions in a soft simpering, insinuating manner, he then, with the utmost politeness of professional assurance, and as a matter of course, slides his hand . . . Nor does the innocent creature thus assailed and outraged rebuke the indecent act.

For long after Smellie's death this controversy regarding male midwifery raged. In Ireland, Sir Fielding Ould (1710–89), whose family has continued in the direct male line for seven generations to the present day, received his share of the abuse and vituperation. When he was knighted some wag wrote:

Sir Fielding Ould is made a knight,
He should have been a lord by right;
For then each lady's prayer would be,
"O Lord, good Lord, deliver me."

The title-pages of three more diatribes written in England during the nineteenth century are given (Figs. 3, 4, 5) and it will be seen that the controversy over male practitioners continued well past the middle of the century. However, the fight against the accoucheur was slowly losing ground, even though the virulence of individual attacks remained undiminished. Illustrative of this is the pamphlet published by John Stevens, "Man Midwifery Exposed" (Fig. 6). Although the exact date of this pamphlet does not appear on the title-page, internal evidence would serve to fix the date as about 1865. The dedication of this work seems interesting enough to quote:



LETTER TO LADIES,

IN FAVOR OF

FEMALE PHYSICIANS.

FOR THEIR OWN SEX.

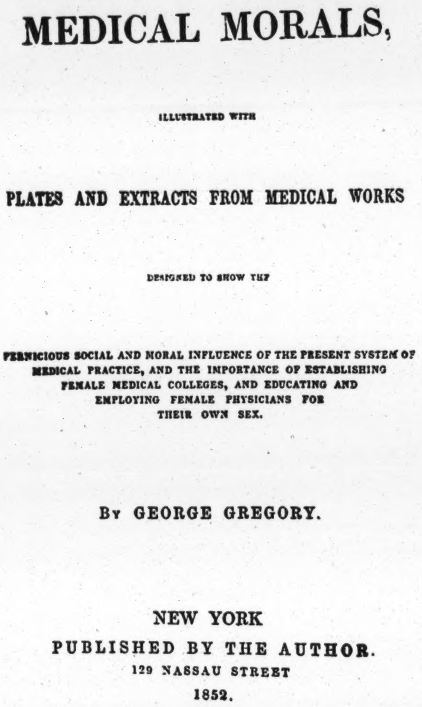
BY SAMUEL GREGORY, A.M.,

Secretary of the American Medical Education Society.

BOSTON:
PUBLISHED BY THE SOCIETY
FOR SALE BY BELA MARSH, 25 CORNHILL; FOWLERS AND
WELLS, 131 NASSAU ST., NEW YORK; AND BY
BOOKSELLERS GENERALLY.
1850

FIG. 6.

To the President, Benevolent Ladies, and Reverend Gentlemen of the SOCIETY FOR THE SUPPRESSION OF VICE . . . From time to time, I have seen, in the public prints, accounts of your laudable intentions and endeavors to suppress the dens of iniquity, bad houses, and snares for the seduction of young and unprotected females. Judging of the nature of your institution by these endeavors on the side of virtue I conceive it to be particularly agreeable to you that a work such as this has been issued from the press, exposing, with a view of suppressing, a deep, silent, secret source of adultery and cruelty—a silent, secret piece of well-dressed vice, fawning to the heart's best affections, like the reptile in the Garden of Eden—a thing which entwines round and fascinates, the more surely to drive home the sting of dishonour, and destroy its unsuspecting victim. A work, seconding your good efforts, is appropriately addressed to you, by Your humble and obedient servant, J. Stevens, M.D.



MEDICAL MORALS,

ILLUSTRATED WITH

PLATES AND EXTRACTS FROM MEDICAL WORKS

DESIGNED TO SHOW THE

PERNICIOUS SOCIAL AND MORAL INFLUENCE OF THE PRESENT SYSTEM OF
MEDICAL PRACTICE, AND THE IMPORTANCE OF ESTABLISHING
FEMALE MEDICAL COLLEGES, AND EDUCATING AND
EMPLOYING FEMALE PHYSICIANS FOR
THEIR OWN SEX.

BY GEORGE GREGORY.

NEW YORK
PUBLISHED BY THE AUTHOR.
129 NASSAU STREET
1852.

FIG. 7.

It is useless to go into more detail on the strife over this subject in Great Britain, but a brief description of its continuation in America is essential. Williams says:

> Owing to the new and unsettled conditions in the United States, and the fact that its largest towns were little more than villages, all the prejudices which existed in England and France against the employment of men in obstetrical work held even stronger sway in America, and consequently male practitioners were practically unheard of until the latter half of the 18th century.

According to Packard, quoted by Williams, the first mention of an American obstetrician is to be found in an obituary notice appearing in a New York newspaper for July 22, 1745.

> Last night died, in the prime of life, to the almost universal regret and sorrow of this city, Mr. John Dupuy, M.D. man-midwife, in which last character it may be said of him as David did of Goliath's sword, "There is none like it."

The most prominent of all the early American obstetricians was Dr. William Shippen, Jr. who returned to Philadelphia in 1762 after having obtained his obstetrical training under John and William Hunter, Smellie, and Mackenzie, and immediately made preparations for giving a course of lectures upon anatomy and midwifery. Shippen with Dr. John Morgan founded the Medical School of the College of Philadelphia, later the University of Pennsylvania, and became its first Professor of Anatomy, Surgery and Midwifery.

An interesting and ingenious, if not very convincing, rebuttal to the arguments of the opponents of male midwifery in America was made by Dr. C. D. Meigs of Philadelphia (about 1850), who argued in favor of the propriety of the innovation on the ground that "the first woman must have been assisted in labor by a man, for Eve could have had no other assistance than that of Adam."

Williams gives an interesting account of the demonstration, and its sequelae, of parturition before a medical class:

To Prof. James P. White of Buffalo (1811–81) belongs the credit of being the first American to demonstrate obstetrical cases before large classes, having, in 1850, delivered an Irish girl, named Mary Watson, in the presence of the graduating class of the Buffalo Medical College. This was regarded as a very questionable innovation, and was the cause of many protests in the newspapers and religious journals, some of which were so virulent in their attacks upon the professor and his methods that he felt it necessary to invoke the protection of the law, and accordingly instituted a suit for criminal libel against Dr. Horatio N. Loomis, who was particularly bitter in his denunciations. During this trial large numbers of medical men were questioned as to the necessity and advisability of the demonstration of women in labor before medical students; and strange as it may now appear, many could be found who were willing to testify that it was quite unnecessary, believing that abundant preparation for the practice of obstetrics could be obtained by the ordinary didactic methods. That the medical profession in America was not thoroughly prepared for such an innovation is rendered evident by the following letter, which was published in the *Buffalo Medical Journal* for March, 1850, and signed by seventeen physicians of Buffalo:

Sirs:—The undersigned, members of the medical profession, have noted with regret in the February number of your journal the editorial article and correspondence to which it refers, entitled, "Demonstrative Midwifery." The propriety of the exhibition of the living subject before the graduating class at the College, as we understand it, does not in our view admit of a public discussion; and our only object in this communication is to say that the practice does not commend itself to the cordial approbation of the medical profession of Buffalo, but on the contrary merits a severe rebuke, because we deem it unnecessary for the purposes of teaching, unprofessional in manner, and grossly offensive alike to morality and common decency. For the credit of the medical profession we hope that this innovation will not be repeated in this or any civilized country. Doubts as to the propriety of such a procedure were likewise expressed in other parts of the country, and became so widespread that the question was referred to the Committee on Education of the American Medical Association. In its report, presented in 1851, this Committee took the ground that the only advantage which could be gained by exposing the patient was a somewhat greater facility in protecting the perineum; but held that this did not compensate for the obvious disadvantages of the method, as they considered that a physician who was not prepared to conduct labor by the sense of touch alone was not competent to practice obstetrics.

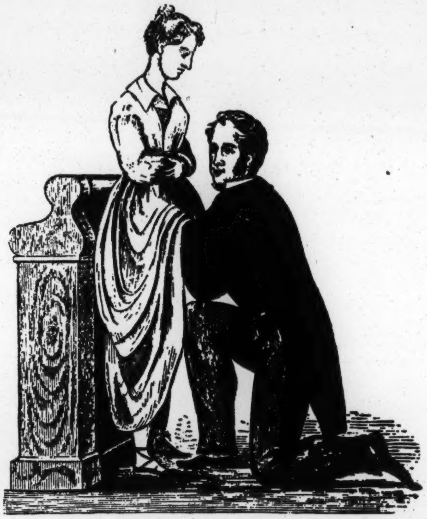


FIG. 8. FROM GREGORY'S "MEDICAL MORALS."

Undoubtedly some of this adverse sentiment was fostered by the pamphlets written by the two Gregorys, George and Samuel (Figs. 6, 7). In "Medical Morals" by George Gregory appear two cuts (Figs. 8, 9) exposing the horror of vaginal examination or "touching." It is very interesting to note how the author played up to popular imagination by the subtle touch of transparent drapes in the case of the lady reclining on the couch. "Medical Morals," especially, represents an appeal to the emotional side of the question.

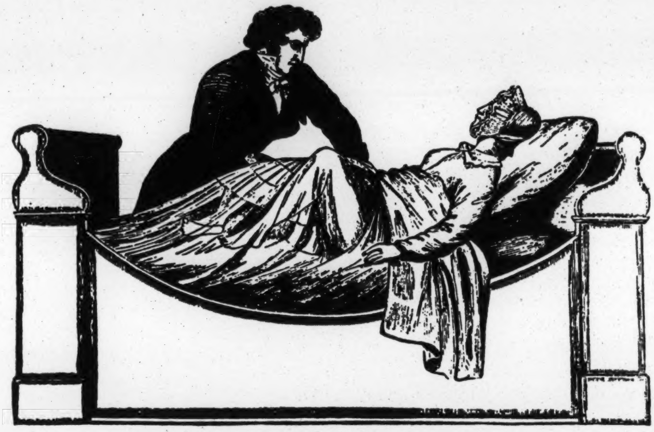


Fig. 9. From Gregory's "Medical Morals."

However, despite the untiring efforts of the various zealots, the trend of the times was toward placing obstetrics on a more rational and scientific basis, comparable to that of the other medical specialties. As this could only be done by studying normal labor, examinations were permitted, and men were admitted to the delivery chamber as a matter of preference, rather than as a matter of necessity in cases which had exceeded the limits of normality.

We have seen then, that with few exceptions, women have handled cases of labor from time immemorial. Male midwifery enjoyed a period of being in fashion during the times when the French court was in all its glory, but it was not until the invention of the obstetric forceps, and even then, not until its use was clearly understood, that the real "obstetrical revolution" took place, and men assumed the commanding position in obstetrics. Naturally, there followed a period of strife which lasted nearly a century, but in the end the demand for exact knowledge in obstetrics triumphed, and the obstetrician of today emerged.

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THE HISTORY OF MADDER (RUBIA TINCTORUM)

By G. R. CAMERON, M.B., B.S., D.SC.*

LONDON, ENG.

THE history of madder begins in the dawn of antiquity. There is some evidence that the Chinese knew the value of the plant as a dye, and it is known to have been employed by the ancient Egyptians, Persians and Indians, possibly being introduced from India by way of Persia and Egypt, and thence to Greece and western Europe. Cloth dyed with madder has been found on Egyptian mummies. Flinders Petrie found in one of the Hawara graves six specimens the pink pigment of which was probably derived from madder. The introduction of madder dyeing into Greece from Egypt seems to be indicated by Herodotus.[1] Sprengel, in his edition of Dioscorides' "De materia medica," says that the Latin name for madder, *Rubia tinctorum*, was really Egyptian in origin and he points out that Philo Alexandrinus translated the Egyptian idiom as *φονὰ ἐϱυϑϱόν*.

A scarlet dye, which was, according to Neuberger, madder, was known to the Jews from earliest times, their knowledge possibly having been obtained during the captivity in Egypt. I am indebted to Mr. V. Green for the following philological commentary. The Hebrew term for scarlet is *thuloth shni* which may be literally rendered "bright worm," as *thuloth* means worm. The Septuagint version of the Old Testament usually translates the Hebrew word as κοκκινον and the Vulgate by *coccinum*, so that it is believed that the cochineal insect, which was known to infest the tubercles of madder or *Rubia tinctorum* was referred to in all of these versions.[2]

Pliny and Vitruvius mention madder under the name of Varantia or Rubia tinctorum, pointing out that it was the *ereuthodanon* or *erythrodanon* of Hippocrates, Dioscorides, Theophrastus and other Greek writers.[3]

The method of employing madder for dyeing cloth, known as the Turkey-red process, in which the madder dye is allowed to act in the presence of mordants such as aluminium and calcium fatty acids, seems to have been introduced from India many centuries ago. Milk was used in conjunction with the Indian madder plant, *munjeet*. No alum was added

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[1] "It would seem that the robe and aegis of Athene were copied by the Greeks from the Libyan women. Nay the very name betrays that the raiment of the statues of Pallas has come from Libya; for the Libyan women wear hairless tasseled goatskins over their dress, coloured with madder and the Greeks have changed the name of these into their Aegis." (*καὶ δὴ καὶ τὸ οὔνομα κατηγορέει ὅτι ἐκ Λιβύης ἥκει ἡ στολὴ τῶν Παλλαδίων αἰγέας γάρ περιβάλλονται ψιλὰς περὶ τὴν ἐσθῆτα θυσανωτὰς αἱ Λίβυσσαι, κεχριμένας ἐρευθεδάνῳ, ἐκ δὲ τῶν αἰγέων τουτέων αἰγίδας οἱ Ἕλληνες μετωνόμασαν.*)

[2] E.g., *Thuloth* is translated as "worm" in Deut. xxviii, 39; Job xxv, 6; Psalms xxii, 6; Isaiah xiv, 11; xli, 14; lxvi, 24; Jonah iv, 7; and refers to the cochineal insect. *Thuloth* (*shni*) is translated as "scarlet" in Genesis xxxviii, 28, 30; Exodus xxv, 4; xxvii, 16; xxviii, 5, 6, 15; xxxv, 6, 25, 35; xxxvi, 8, 35, 37; xxxviii, 18, 23; xxxix, 1, 2, 3; Leviticus xiv, 4, 6, 51, 52; Numbers iv, 8; xix, 6; Joshua ii, 18, 21.

[3] I find no reference to madder, however, in the works of Homer, Theocritus, Bion, Moschus, Megara or the pattern poems of Simias. Propertius does not mention it. The Virgilian poems contain no reference.

* Beit Memorial Fellow, University College Hospital Medical School.

but as Gardner points out the plant with its earthy incrustations almost certainly contained sufficient aluminium to produce the lake. The art spread from the East through Persia and Turkey along the great trade routes. By Pliny's time, the use of madder as a dye for wool and in preparing skins for leather was generally known. Strabo says that madder was cultivated in Gaul, especially in Aquitaine.

By the seventh century after Christ there was a well-established madder trade in Western Europe. The charters of Dagobert and Childebert allowed the roots of madder and its pigment to be sold at the fair of St. Denis. This fair, chartered by Dagobert "in honour of the Lord and to the glory of St. Denys," was held for the ten days following October 10 and attracted merchants from all over Europe and the East. It soon became a market for the iron and lead of the Saxons, for slaves, jewelery and perfumes of the Jews, for the oil, wine and fat of Provençe and Spain, for the honey and madder of Neustria and Brittany, and for merchandise from Egypt and the East.

In the capitularies of Charlemagne, the culture of madder or Warantia was especially recommended. During the Dark Ages, however, its cultivation seems to have been almost completely lost, but with the Crusades and the intimate contact of the Occident with the Orient reestablishment of madder growing in the more western parts of Europe, especially in Italy and perhaps in France, took place. The Moors were mainly responsible for its reintroduction into some parts of Spain. By the thirteenth century it appears that the pigment of madder was widely known throughout Europe. In England there is considerable evidence that such a pigment was in common use by the middle of the 14th century. Alcherius says that "sinopis is a colour redder than vermilion and it is made from varancia." The Sloane MS. No. 416 speaks of "warancia" and "waranz." English account rolls of the 14th century refer to madder lake as "sinopre" and "cynople." In the notes to Hendrie's "Theophilus" there is a reference to an English manuscript of the 14th century in which directions are given for extracting the coloring matter of "madyr."

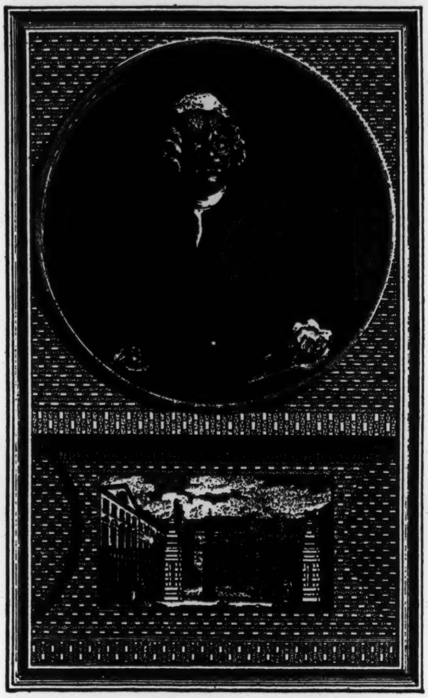

FIG. 1. JOHN BELCHIER M.D., PHYSICIAN AND SURGEON TO ST. THOMAS'S AND GUY'S HOSPITALS AND ONE OF THE GOVERNORS OF GUY'S HOSPITAL.

Towards the middle of the 16th century, madder was extensively cultivated in Alsace, Flanders and Holland, chiefly in the province of Zealand[4] where it was especially encouraged by Charles the Fifth. In Germany it was especially grown in Silesia where it was introduced in 1507 by Jean Huller. It was grown in Bohemia in the 16th and 17th centuries, but the commerce was ruined during the Thirty Years' War. In France, the madder industry does not appear to have been of any importance until the end of the 18th century, although Colbert had introduced madder cultivation into the Comtat d'Avignon in 1666. Louis xv (*c.* 1756) exempted from imposition for twenty years those who grew madder in the marshes. The establishment of the industry seems to have been due mainly to Althen, a native of Yulfa, a suburb of Ispahan, and a statue to his memory stands in the city of Avignon. Greek dyers introduced the Turkey red industry into Rouen, Lyons and Languedoc. During the wars of the republic, madder culture was practically abandoned in France, and only after 1815 did it become regular again. Until the discovery of alizarin by Robiquet and Colin in 1826 and its synthesis by Perkin in 1869 European madder was grown chiefly in Zealand, the south of France (especially in the Palud, a chalky valley near Vaucluse) and the Levant. Although Rubia peregrina grows naturally in Great Britain, R. tinctorum has never been extensively cultivated there, the greater portion of the dye being imported from Zealand and France. Its value as a dye was, however, well recognized by the middle of the 17th century. Sir William Petty (1662) in what appears to be the first account published in English of the operations used by dyers, writes:

> Mather is a Root cultivated much in Flanders. There be of it two sorts, Pipe Mather, which is the coursest; and Bale-Mather, otherwise called Crap-Mather. This Mather used to the best advantage, dyeth on Cloth a colour the neerest to our Bow dye, or the new Scarlet; the like whereof Safflowr cloth in Silk, insomuch as the colours called Bastard-Scarlets are dyed with it. This colour indures much boyling, and is used both with Allum and Argol: it holdeth well. The brightest colours dyed with this material are made by over-dyeing the same, and then by discharging part of it by back-boyling it in Argol. Mather is used with Bran-liquor, instead of White liquor or ordinary Water.

It is of interest to find that in this same communication, Petty forestalls the physical theory of dyeing:

> So as the flower of the Bran being joyned with the Mather, and made clammy and glutinous by boyling, I doubt not but both sticking upon the villi of the stuff dyed, the Mather sticks the better by reason of the starchy pastiness of the Branflower joyned with it.

According to Knecht, the first Turkey red dye works were established at Glasgow in 1790, and the industry is still continued in the Vale of Leven.

From earliest times, madder seems to have been employed medicinally. Hippocrates recommended its use in sterility, for obstinate labor pains and in "intestinorum difficultatem." Theophrastus writes:

> Madder has a leaf like ivy, but it is rounder: it grows along the ground like dog's tooth grass and loves shady spots. It has diuretic properties, wherefor it is

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[4] A curious custom associated with the madder harvest in Zealand is recorded by Sir James Frazer in "The Golden Bough," Spirits of the Corn and of the Wild. Pt. v, pp. 231, 235.

used for pains in the loins or hip disease. (Sir Arthur Hort's translation, Loeb classical library.)

Τὸ δὲ ἐρευθεδανὸν φύλλον ὅμοιον κιττῷ πλὴν στρογγυλότερον· φύεται δ' ἐπὶ γῆς ὥσπερ ἄγρωστις, φιλεῖ δὲ παλίσκια χωρία. οὐρητικὴ δέ, δι' ὃ καὶ χρῶνται πρὸς τὰ τῆς ὀσφύος ἀλγήματα καὶ πρὸς τὰς ἰσχιάδας.

Dioscorides says:

Κεφ. ρν́. (ρξ'.) [Περὶ 'Ερυθροδάνου.] 'Ερυθρόδανον, ἢ ἐρευθόδανον, ἔνιοι δὲ τεύθριον καλοῦσι, οἱ δὲ δράκανος, οἱ δὲ κιννάβαρις, 'Ρωμαῖοι ῥουβία πασσίβα, Θούσκοι λάππα μίνωρ, Αἰγύπτιοι σωφοβί. 'Ρίζα δέ ἐστιν ἐρυθρὰ, βαφική· ἡ μέντις ἀγρία, ἡ δὲ σπαρτὴ, ὡς ἐν Ταβιάνη τῆς Γαλατίας[16] καὶ 'Ραβέννη τῆς 'Ιταλίας, καὶ ἐν Καρίᾳ μεταξὺ τῶν ἐλαιῶν[17] σπειρόμενον, ὥςπερ ἐν ταῖς ἀρούραις· ὠφελίμως δὲ σπείρεται[18], διὰ τὸ γίνεσθαι ἐκ τούτου πλείστην πρόςοδον. Εἰσὶ δὲ αὐτοῦ οἱ καυλοὶ τετράγωνοι, μακροὶ, τραχεῖς, ὅμοιοι τοῖς τῆς ἀπαρίνης, κατὰ πάντα δὲ μείζονες καὶ ῥωμαλεώτεροι, ἔχοντες ἐκ διαστημάτων τὰ φύλλα καθ' ἕκαστον γόνυ, ὥςπερ ἀστέρας εἰς κύκλον περικείμενα· καρπὸν στρογγύλον, τὰ πρῶτα χλωρὸν, εἶτα ἐρυθρὸν, εἶτα πεπαινόμενον μέλανα· ῥίζα λεπτὴ, μακρὰ, ἐρυθρὰ, διουρητική· ὅθεν ἰκτερικοῖς μετὰ μελικράτου πινομένη βοηθεῖ, ἰσχιαδικοῖς τε καὶ παραλελυμένοις· ἄγει δὲ οὖρα πολλὰ καὶ παχέα, ἔσθ' ὅτε δὲ καὶ αἷμα. λούεσθαι μέντοι δεῖ καθ' ἡμέραν τοὺς πίνοντας, [καὶ ὁρᾷν τῶν κενουμένων τὴν διαφοράν][19]. θηριοδήκτοις τε βοηθεῖ ὁ χυλὸς μετὰ τῶν φύλλων ποθεὶς[26]. ὁ δὲ καρπὸς μετ' ὀξυμέλιτος πινόμενος σπλῆνα τήκει· προςτεθεῖσα δὲ ἡ ῥίζα ἔμβρυα καὶ ἔμμηνα ἄγει καὶ δεύτερα· θεραπεύει δὲ καὶ ἀλφοὺς μετ' ὄξους καταπλασσομένη[21].

A full description is given by Pliny[5] who writes:

Sunt etiamnú duo genera nó nisi sordido nota vulgo, cú quaestu nullo polleát. In primis rubia tingedis lanis et coriis necessaria Laudatissima Italica, et maxie suburbana, et omes pene puinciae scatent ea. Sponte puenit, seriturque similitudine eruiliae. Ver spinosus ei caulis et geniculatus hic est quinis circa articulos in orbe foliis. Seme eius rubru est. Quot in medicina usus habet suo dicemus loco.

Erythrodanus quá aliqui eruthrodanú vocant, nos rubiam, qua tingútur lanae pellesque perficiunt, in medicina Uriam ciet, morbú regium sanat ex aqua mulsa. Et lychenas ex aceto illita. Et ischiaticos

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[5] "There are two other plants also, which are but little known to any but the herd of the sordid and avaricious and this because of the large profits that are derived from them. The first of these is madder, the employment of which is necessary in dyeing wool and leather. The madder of Italy is the most esteemed, and that particularly which is grown in the suburbs of the City; nearly all our provinces, too produce it in great abundance. It grows spontaneously, but is capable of reproduction by sowing, much after the same manner as the fitch. The stem, however, is prickly, and articulated, with 5 leaves arranged round each joint; the seed is red. Its medicinal properties we shall have occasion to mention in the appropriate place." (Bk. XIX, "Madder," Bostock and Riley's trans., Bohn, 1856.)

"The erythrodonus, by some called eruthrodanus and in Latin rubia, is quite a different plant. It is used for dyeing wool, and skins for leather are prepared with it. Used medicinally, it is a diuretic, and employed with hydromel it is curative of jaundice. Employed topically with vinegar it heals lichens; and a potion is prepared from it for sciatica and paralysis, the patient while using it taking a bath daily. The root of it and the seed are effectual as an emmenagogue; they act astringently upon the bowels and disperse gatherings. The branches, together with the leaves, are applied to wounds inflicted by serpents; the leaves too have the property of staining the hair. I find it stated by some writers that this shrub is curative of jaundice; even if worn as an amulet only, and looked at every now and then." (Book XXIV, "The erythrodanus; eleven remedies." Bostock and Riley's trans., Bohn, 1856.)

> et paralyticos ita ut biberes lavet quottidie. Radix seméque trahuit méses, aluum sistunt, et collectiones discutiút. Contra serpétes rami cum foliis imponút. Folia et capillu tingunt. Inuenio apud quosdá morbú regium sanari hoc frutice, etiam si adaligat spectet tantú.

Pliny's indebtedness to the Greek writers is apparent. His influence on subsequent medical commentators, is, however, very striking and Galen, Aetius and Paulus Aegineta follow his description closely.[6]

The Arabian writers (Avicenna, Rhases, Casiri) apparently agreed with the Greeks (see Francis Adams' commentary to Paulus Aegineta, Sydenham Society, 1847). Nowhere is this so obvious as in the herbals and materiae medicae of the sixteenth, seventeenth and eighteenth centuries.[7] The following quotation from Leonhart Fuchs' "Kreuter Buch" of 1543 (cap. CVII) is practically a translation of Pliny's account, with the addition of the statement that madder purifies the liver, spleen, kidneys and uterus, and makes the spleen smaller.

> Die wurtzel mit meth gesotten und getruncken treibt den groben harn vilfeltig und mit gewalt / also das auch zu zeiten das blut hernach gut. Diser gestalt gebraucht bringt sieden frawen ihre kranckheyt so sich ein zeit lang verhindert hat. Sie bekompt such wol dem hüfftsuchtigen / unnd denen so lam in glidern seind / gleichen weiss genomen. Doch sollen die so darnon trincken / alle tag baden / und eben acht nemen der überflüssigkeyt so auss dem leib getriben worden. Der safft von der wurtzel getruncken ist gut denen so von gifftigen thiern gebissen seind. Dessgleichen thut auch das kraut / oder die bletter in wein gesotten und getruncken. Die wurtzel in hoenigwasser gesotten und getruncken / eroeffnet und reyniget die leber / milz / nieren / unnd mutter. Ist ein kostlich tranck zu der geelsucht. Der samen mit Oxymel in den Apotecken geheyssen ingenomen macht das milz klein. So man zaepfflin auss der wurtzel macht un in die muter thut / bringt sie den frawen ir kranckheyt / und zeücht herauss das nachbürdlin / und die todten geburt. Mit essig zertossen unnd angestrichen / heylet sie allerley maeler unnd flecken der hair / als seind die flechten unnd zittermaeler.

Very similar descriptions of the properties of madder are given by Matthiolus (1563), Dodonaeus (1583), Parkinson (1640), Culpepper (1653), Fernel (1656), Tournefort (1716), and Lewis (1741). The first signs of revolt against the classical orthodoxy are to be plainly seen in Gerard's "Herball" (1597). Gerard writes:

> Dioscorides reporteth that the root of madder doth plentifully provide urine, and that grosse and thicke, and sometimes blood also, and it is so great an opener that being but onely applied it bringeth down the menses, the birth and the after-birth; but the extreme redness of the urine deceived him, that immediately followed the taking of madder, which redness came as he thought from blood mixed therewith, which notwithstanding cometh no otherwise than from the colour of the madder. . . . It manifestly follows that Dioscorides hath rashly attributed unto it this kind of quality, and after him Galen and the

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[6] The latter for example, writes: "Erythrodanon is the Rubia tinctorum. Being sour and bitter, it purges the spleen, liver and kidneys, so as to occasion a discharge of bloody urine. It acts as an emmenagogue, and cleanses the sordes of the skin."

[7] Through the courtesy of Prof. E. J. Salisbury, I have been able to examine the valuable collection of herbals collected by Professor Oliver during his association with the Department of Botany at University College.

rest that followed standing stiffly to this opinion.

Cullen (1789) denies its diuretic action, and doubts its value as an emmenagogue. The third edition of Murray's "Materia medica," 1816, states that "its inefficiency is generally acknowledged." In more modern pharmacopeias, madder receives very little serious attention and it is certain that it possesses no definite therapeutic value.[8]

There is, however, a very interesting and important property of madder which deserves some attention, namely its power of staining the bones when administered to living animals. Stieff has suggested that the people in the neighborhood of Breslau, who gave the stalks of the madder plant to their cows instead of straw, must have first discovered that it possessed the property of coloring the bones. Whether this be true or not, it seems fairly certain that the first clear description was given in 1564 by a Dutch physician, Lemnius, in the second edition of his "De miraculis occultis naturae." Shortly afterwards the astrologer Antonius Mizaldus (1589) wrote in his "Memorabilium utilium et jucundorum centurie IX": "Erythrodanum, vulgo rubia tinctorum dictium ossa pecudum rubenti et sandycino colore imbuit si dies aliquot illud depastae sint oves." These observations attracted little attention. The publication in the *Philosophical Transactions* of 1736 by John Belchier of "An account of the bones of animals being changed to a red colour by aliment only" at once aroused considerable interest, especially in France, where Duhamel in a series of researches extending over the period 1739–57, established the fact that during bone growth only the newly formed bone stains red. I do not propose to discuss the literature on this subject at length, for that I have already done elsewhere. Belchier and Duhamel's observations were quickly confirmed by J. B. Boehmer (1752), Dehtleff (1753), A. v. Haller (1758–66) and his pupils, Canals (1763) and Lesbros de la Versane (1768). Boehmer (1752) and Dehtleff (1753) described the staining of newly formed fracture callus after the administration of madder. The experiments of John Hunter (1764) are well known.

> He fed two pigs with madder for a fortnight and at the end of that period one of them was killed; the bones, upon examination externally had a red appearance; when sections were made of one of them the exterior part was found to be principally coloured, and the interior was much less tinged. The other pig was allowed to live a fortnight longer, but had now no madder in its food; it was then killed and the exterior part of the bones was found of the natural colour, but the interior was red. (Everard Home.)

Hunter also noted that any part of a bone which is already formed is capable of being dyed with madder, though not so fast as the part that is unformed. In this observation, Hunter was far ahead of most observers that have worked with madder, and it has remained for H. A. Harris (1921) to bring out the full significance of this fact in connection with the deposition of calcium salts in bone. The earlier literature on madder feeding is fully discussed by Duhamel in his "Memoire sur la garance,"[9] Platner in the "Disputationum anatomicarum selectiorum,"[10] and by A. v. Haller in his "Elementa physiologiae corporis humani."[11] An attempt was made to introduce madder in the treatment of rickets by Robert (1758), Cosnier (1762), Hansen (1762), Oetinger (1769).

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[8] Francis Adams states that Rubia tinctorum was still retained in the modern Greek Pharmacopeia (1847).

[9] Paris, 1757.

[10] Vol. 6, Ed. by A. v. Haller, 1751.

More recent work has been concerned with the elaboration of these simple madder experiments, more especially the investigation of species behavior, and subsequent to the identification of alizarin as the most important constituent of madder, the investigation of this dye as a means of staining bone. Lieberkühn (1867) appears to be the first to have administered alizarin as sodium alizarinate intravenously and described results similar to those obtained after feeding with madder. Since then, most investigators have adopted the sodium alizarinate method, though there has been a tendency in recent years to return to the original madder method (e.g., Brash, 1924; Handelsmann and Gordon, 1930).

In conclusion, it is of interest to note that madder has frequently served as an artist's pigment. Church mentions that both Michelangelo Buonarroti and Ghirlandaio used madder-lake, pictures Nos. 790 and 1143 in the National Gallery, London, illustrating very well the use of madder in this connection.

The remarkable green mixtures by Titian, Bordone and the van Eycks consisted of a deep yellow lake (of saffron) mixed with lapis lazuli or mountain blue, together with egg yellow. Madder was sometimes added to give a warmer effect (Raehlmann).

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ENTELECHY AND SCIENTIFIC DETERMINISM IN MEDICINE

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IF there is one thing in Nature and in Life that is constant and unrelenting it is action and reaction. Beginning with the electron and proton all the way to the highest mountain and deepest valleys on the earth's surface, there is a rhythmic systole and diastole to all things: the sphygmogram of a capillary blood vessel, or a jugular vein, the black line in a piece of Tennessee marble, the rise and fall of the ocean's tide. The tracing on the seismograph, all things of the earth and earth itself evidence a to-and-fro movement and a constant flux. Not only is this true of material things in Nature, it is equally true in the intellectual life of Man. The upward and downward, the forward and backward movements of Man's thinking is clearly written across the pages of history. We read of Golden Eras followed by Dark Ages and periods of enlightenment followed by medievalism. The inexorable law is that of motion and change.

For a century the best of men have given their lives to science. Compared to this golden age of science, other centuries pale into insignificance. The wisdom of Pericles and Hippocrates, of Sophocles, Euripedes and Aristophanes does not compare with the diffuse enlightenment of the present century. Science has released man from his fears and superstitions, from his blind servility and his genuflexion and withal has preserved for him the saving grace of humility. Man has learned that he is as much a part of Nature as the various elements of which he is composed.

Science has forced a revaluation of values. It has made the spuriously great to be insignificant; it has also shown that the great resides within the insignificant. It has cast aside the false standards of fat and degenerate antiquities.

But, Homo sapiens, being what he is, is again dissatisfied. Disregarding what Science has accomplished, man seems to apprehend a Frankenstein looming over him. Therefore we read in our present-day literature that the Machine Age spells failure, that the death knell has been rung and the curtain is to fall on Science, and that the time has come for us to declare a scientific holiday.

I have often wondered whether this movement has come about spontaneously, if it is a phenomenon, or if it is the handiwork of a remote group of Sanhedrim closeted somewhere and in secrecy deciding on what is good for mere man. This present-day reactionary attitude has become manifest not only in mathematical, physical and philosophical circles, but we hear it re-echoed in our own world, in the field of Biology and in the halls of Medicine.

Having just settled down to real science in medicine and being actually at the threshold of discoveries by which human life might be prolonged and existence made more worth while, we have suddenly been made to feel a chill, a cold eastern wind, blowing from the Continent. This time it comes from England, the England of Bacon, of Locke, Newton, Dalton, Darwin, Thompson, Rutherford and Bertrand Russell. Also the England of Bishop Berkeley, Sir Oliver Lodge, and Sir Arthur Conan Doyle.

Charles Singer, lecturer, University of London, in his recent "Short History of Medicine," practically affirms his belief in the philosophy of Vitalism. This is not the position of an isolated individual, it represents a trend of thought. There are many scientists of his mind throughout the world, and it is for them that he speaks to the medical profession.

Vitalism, as you remember, began with Aristotle. Aristotle held that Nature produces nothing in vain, that every natural action has a certain object. Plants exist for animals, animals exist for man, everything in Nature exists for the benefit of another. Aristotle declared that behind this scheme there is a Prime Cause, a Final Cause, an Unmoved Mover.

This whole idea translated in the vernacular of the present-day medicine, is to be found in the Epilogue of Singer's "History of Medicine."

> The Triumph of Physic has underlying it a subtler triumph, that of Scientific Determinism. The great increase in the detailed knowledge of Nature has led to a great increase in the belief in the Reign of Law. The triumphs of science have been secured by disregarding mind, and yet they cannot be appreciated or advanced without invoking mind. Unless we accept the full conclusion of the Determinist Philosophy, we are forced to the conclusion that mind must do something to the animal body. If mind holds the reins, there must be a point at which mind pulls the reins. The matter ever in dispute is where that point may be. If life and growth are bound up with an Entelechy, there must somehow and somewhere be a level in the organism at which the laws of Physics and Chemistry are transcended by some other mode of action.

It is evident that Singer assumes the existence of a principle within living things which cannot be expressed in chemical or physical terms and that this principle works to an intelligent end, and that some unknown purposiveness exists beyond that which we can see and hear and feel and think. Those of you who read philosophy will know that here the Entelechy of Aristotle, Bergson's Creative Evolution and the Vitalism and Entelechy of Driesch speak aloud.

Whitehead, one of our modern philosophers, believes that mental states enter into the plan of the entire organism, influencing it in its smallest subdivision and functions. "Even the electrons run in accordance with the function of the entire organism." This he calls the doctrine of organisms or the theory of organic mechanisms, and in reality is another interpretation of the theory of vitalism.

All of which brings clearly before us the question as to whether we of today, in medicine, shall continue along the paths of scientific determinism or accept the entelechy of vitalism of Aristotle as our philosophy. The question with us is, whether there is or is not a level at which the mechanistic influence, the chemistry and physics of the body ends and a higher driving force, the entelechy, begins.

If you can sympathize with the viewpoint of the late Henri Poincaré that the chief end in life is contemplation, or with Einstein who holds that after all, life's chief joy is comprehension, then I will ask you to follow me while I review the background of some of our ideas.

Let us review some of the high spots in philosophy, both old and new, and the sciences upon which these philosophies were erected. Where and how did Aristotle and those before him conceive the idea of an entelechy? And where and how did science and the philosophy of science begin and establish itself?

Older than Babylonia and older than the Pyramids of Cheops and more silent than the Sphinx on the desert, is the clue to the origin of man's contemplations and his philosophy. Like the Sphinx its outlines are less sharp by day; and it seems only to take its true form in the night when the eyes see less and the imagination sees more.

Somewhere in his extensive wanderings in Egypt, Pythagoras garnered the fruits of oriental wisdom and philosophy and brought them to southern Italy where he and his school flourished five hundred years B.C. From there his influence moved farther into Italy and to Greece. His theory of the transmigration of the soul and the doctrine of the property of mystic power of numbers was interpreted and re-interpreted. There are evidences suggesting that some of these ideas existed among the Egyptians more than 4000 years B.C., already legend when the Sphinx was created.

If, as we read in Herodotus, Egyptians believed that the soul migrated and transmigrated from man to animal and again to man, why may it not very well be, as Aristotle later said, that the soul is the animating and controlling force over the body? Why not call this force the Entelechy, the Vitalistic Principle? An easy enough adaptation and philosophy in the absence of science.

After Pythagoras, Thales expounded the idea that the great principle of all things is water. Anaxamines believed that air, fire and earth contained the principal force. Democritus believed that body and soul are made up of atoms of different shapes and sizes and that constant movement of these atoms keeps body and mind in action. "All things are in incessant flux," said Democritus, "and permanence is only an illusion. There are only atoms and space."

It was Heraclitus who said, "Nothing originates and nothing is destroyed; all is mixed and unmixed out of pre-existent things."

Is it not strange that these Ionic philosophers, who spent so much time in reasoning and speculation and so little in obtaining positive knowledge, should have come as near to what we of today consider great truths in modern science? Or is it possible that the thinking of those times was not really great and that it is we of today who are the laggards? Can it be that with all our apparent progress we have been mentally fettered and unable to escape the mode of thinking of the past four thousand years?

Socrates (469–399 B.C.) believed in a Supreme Intelligence of the universe that ordered all things with design.

Plato (429–347 B.C.) pupil of Socrates, aimed to establish principles and objective reality. Plato synthesized Science into Philosophy. Plato considered individual soul the same as universal soul; that the soul sways the body as the body sways the soul. "Some diseases," said Plato, "can be treated only through the mind." Idealist that he was, he evaluated the priest who healed the soul higher than the physician who healed the body.

Aristotle (384–322 B.C.) held that the existence of the universe is not due to chance; that corporeal objects come only out of corporeal substances, and the variety of things in the universe is a result of design. "Body and soul exist separately," said Aristotle. The Entelechies are the intermediates between body and soul. Soul is the vital principle of any organism. Matter changes form endlessly and the urge behind this change is the unmoved Prime Mover. Nature does not change, and the Materia Prima is eternal.

You will be interested to know that as tutor to Alexander the Great, Aristotle is said to have had at his command, at one time, a thousand men to collect zoological and botanical material which was classified and recorded. His writings became the text for two thousand foggy years.

Following Aristotle were the Sophists, too subjective; the Stoics, too pragmatic; the Epicureans, too materialistic; and the Skeptics, too skeptical of everything including themselves. None of these philosophies had enough in it to withstand the criticism of time.

Bacon, two thousand years after Aristotle, came as a severe critic of medievalism, resenting the barren and fruitless discussion of those days. He became the spokesman of a searching realism. Bacon insisted on a new basis of knowledge and new principles of science. Bruno and Galileo forwarded science in their day, and after them came Descartes. Descartes (1596–1650) said: "We must doubt all things that appear in the least degree uncertain," just as Father Abélard had said: "The beginning of wisdom is found in doubting. By doubting we come to examine and by examination we come upon truth."

Descartes held that body and soul are independent of each other. The body obeys its laws and reflexes and the soul has its own. The body itself is an automaton, a machine, but within the body there dwells the soul which resides in the pineal gland. Thus affections of the body may act on the soul and affections of the soul may act on the body.

According to Spinoza, spirit cannot act on matter or matter on spirit. All is one substance with no line of demarcation. In fact, both body and soul are but extension and thought of the same substance, Nature.

Locke (1632–1704) physician and philosopher, was a realist and materialist of the truest form. "The mind," said Locke, "is a mirror only reflecting the things that fall upon it. The soul is secondary to matter." Locke emphasized the importance of cause and effect.

Berkeley, on the other hand, maintained that everything is mental and that matter is not real. Opposed to these ideas was Hume who held that the soul, being a complex of our ideas, ceases with these and ceases when the movement of the body ceases.

The members of the French School were clear-cut materialists. Condillac, Voltaire, Diderot and La Mettrie the physician, were the noteworthy philosophers of that period.

Kant, in his "Kritik of Pure Reason," reasoned out the undemonstrability of God, free will and immortality. Hegel believed that all that is rational is real, and all that is real is rational.

Spencer, as a scientist, could not conceive anything beginningless or uncaused, but that "all ultimate causes are beyond rational conception."

Bergson claimed that there is an Entelechy, a dominating influence governing the purpose of the whole. It is the *élan vitale*, the vital urge, which moves us to unceasing action and creation. Bergson protests against material mechanism. "Life is something more than machinery, it can grow, restore itself, and mold its environment to a certain extent . . . There is a design in things, in them, not outside," said Bergson.

Santayana believed that "science contains all the trustworthy knowledge, but our pundits in the laboratory are too confident," said he.

Centuries roll on; the Pyramids, the Sphinx and the desert remain silent as to most of what has gone before, and as to what is yet to come. Man trudges onward with doubt and hesitation.

Aristotle once said that there is no motion except in time and time can only be perceived by motion. Since the days of Aristotle there has been time and there has been motion, but in some ways, one is tempted to remark, there has been little progression.

So much for the philosophical evidence in the case.

It is not enough to say that a certain trend in thought came about; it is necessary to show how it came about.

Medical: Let us therefore turn to the biological and medical side of the problem to see what has occupied the mind of the scientist and physician during the past twenty-five centuries.

While chaos, superstition and ignorance of the early days are largely things of the past, it is important to realize that even today Medicine is not yet counted as one of the fundamental sciences. A few remarks concerning the background of Medicine's early days may not be out of order.

It is true that we were among the first to use numbers in a scientific way, but alongside this scientific effort there has always been a certain amount of mysticism, false doctrine and superstition, introduced largely by the needs of the patient, rather than the illogic of the physician. The oath of Hippocrates (460 B.C.) which adorns our walls even today is dedicated to Apollo; and those who transgress it are threatened with punishment by all the gods and goddesses. This mode of thinking in point of time stands side by side with the Entelechy of Aristotle (384 B.C.).

Erasistratus tended toward a materialistic philosophy and opposed the Entelechy of Aristotle. Plato said that the physician may be a good judge of health, but he knows not whether it is better to get well or die. Hippocrates is credited with having said that one should not interfere with those that are mastered by disease. That may have been true up to the time of Aretaeus. But Aretaeus, four hundred years after Plato, taught that it was wrong not to treat all who ailed, and that we should aim at curing even incurable diseases.

Galen's philosophy was that of Vitalism or Idealism.

The Middle Ages, after Galen, slept for a thousand years and then awakened. With this awakening, Paganism was cast aside, Christianity was established and a renewed interest in science and in medicine made its appearance.

In discussing the origin of modern science, Whitehead offers a very interesting viewpoint:

> Fate in Greek Tragedy becomes the order of Nature in modern thought, Fate, remorseless and indifferent, urging a tragic incident to its inevitable issue, is

the vision possessed by Science. This remorseless inevitableness is what pervades Scientific thought. The laws of physics are the decrees of fate. Thus the spectacle of a moral order was impressed upon the imagination of a classical civilization. Society of the days of the ancient Greek Tragedians decayed, the influence of their literature vanished, but the concept of the moral order and the order of Nature remained and influenced the mentality of the Middle Ages, implanted the habit of exact thought; it prepared the mind for the appreciation of a relationship between succeeding events and exemplification of underlying principles.

This mode of thought made science possible. Although germinated in a period of darkness, in due time it brought great illumination.

The natural sciences developed rapidly.

Lavoisier (1743–1794): From the seventeenth to the eighteenth century, we find chemistry on a better footing. Gases were recognized. Lavoisier at first uncovered some of the principles for which Greek philosophers had been groping in the days of Heraclitus, Anaximenes and Empedocles. Lavoisier proved that oxygen is the essential element in respiration, and therefore of life. He showed that animal life and heat are dependent on oxidation. "Animal and man, like a burning piece of wood, absorb oxygen and eliminate CO_2. When plants burn, CO_2 and H_2O result."

What a sobering effect this discovery must have had on the philosophic concepts of that day. With one master stroke Lavoisier proved that man, animal and plant are part of the same universe; breathing, living and dying by the same laws. When the harmonious function of an organism is disturbed, be it the result of physical or chemical insult, death follows. King and serf, man and brute, animal and plant all bow to the same force and none are favored by the inexorable laws of Nature.

This discovery, properly evaluated, has in it a kind of Spinozian universalism. Whatever conceptions philosophers may have held concerning the soul, entelechy or vitalism, oxygen it is that determines action or inaction, life or death. Whether it be a single cell, as in the artificial parthenogenesis of Jacques Loeb, whether it is in the life of a man or in all of mankind, whether it is an engine, a plant, the planet earth or even the universe; without oxygen everything must stop, immediately. What motivates the oxygen? That remains unknown. The evidence that Lavoisier presented was unmistakable. Not mind, or will, or psyche, or ego, can halt or delay the irrevocable laws of Nature.

Galileo had already discovered the microscope and telescope, and with them increased the range of the sense organs, and with them human knowledge and power. Harvey described the circulation, Van Leeuwenhoek found germs, and Boyle weighed gases. Many things were happening. The laws and workings of Nature were being unfolded before the eyes of man beyond his wildest dreams.

Dalton's studies (1808) led to the present-day theory of atomic structure and weight. His observations on color blindness, Daltonism, of which he himself was a victim, was the work of a pioneer in science. Dalton made it clear that grass is green providing that our retinal structures registering green are normal. If certain rods or cones are not physiologically normal in an individual, then for him there may be no red or blue or violet or green.

Can you not see the philosophic implication of these facts? Can you not see that without these rods or cones in the retina or without eyes and without mind there is no such hue as green?

Sir Humphry Davy (1778–1829) demonstrated the possibilities of laughing gas. Mind or no mind, here is a chemical, a gas, which suspends consciousness, subdues the ego, the will, the psyche.

Johannes Müller (1801–1858) surely gave philosophers food for thought. In his law of specific energies he demonstrated that objective realities became real to us because of their effects on our sense organs. Altered sense organs, altered world.

Wöhler (1828) synthesized urea. Up to that time it was considered impossible to create organic substances out of inorganic materials.

Claude Bernard (1813–1878) showed that disease was not a matter of chance, but that it had a direct relationship to some antecedent cause; diseases could be produced experimentally. His famous piqûre experiment, puncturing the floor of the fourth ventricle, with resulting glycosuria, you well know.

Darwin's (1809–1882) theory of evolution set the philosophic and idealistic world agog. Good citizens studied it behind shutters, ministers of the gospel carried their volumes out into the quiet of the forest to read and to think unobserved. It must have come as a shock and surprise to the vitalists of that day. The theories of evolution and heredity are intimately related.

Mendel (1822–1884), an Austrian prelate, in 1865 threw an altogether new light on the internal biochemical forces at work in transmission of hereditary characteristics. The law of segregation and the law of independent assortment of the genes are fundamental, and comparatively simple. Mendel indicated that there is an actual carrying over of material of a certain composition from one generation to another. This leads to the thought that cytoplasm and genes carry our inheritance and "what goes into the germ plasm must come out in the offspring" (Slye). The work of Mendel and Weismann and others has given biologists the hope that the processes of Nature may yet be wholly approachable to the scientific mind; and to say that the laws of the infinite are inscrutable is only to rest on our ignorance.

Driesch, in the Gifford Lectures of 1907, considered entelechy as the very root of inheritance. "The real starting point in Morphogenesis cannot be regarded as a machine," said Driesch, "and there is a life autonomy which goes beyond the mechanistic theory of life." Driesch admitted, however, that the results of his studies were negative rather than positive.

Virchow's (1821–1902) cellular pathology came into being in 1858. In this he expounded the view that the body was a cell state in which each cell, having a life of its own, is a citizen. Disease of the cell leads to disease of the organ, and disease of the organ leads to disease of the body. This too has its philosophic implications. Virchow was not all materialist.

Bacterial Cell Life: Let me recall to your minds the period between 1867 and 1905: antiseptic surgery of Lister, 1867; knowledge of traumatic infection, Koch, 1878; Neisser's gonococcus, 1879; staphylococcus and bacillus of Eberth, 1880; Plasmodium malaria of Laveran, 1881; tubercle bacillus of

Koch and bacillus of glanders, 1882; vaccination against glanders, 1883; Behring's diphtheria antitoxin, 1890; Spirocheta pallida of Schaudin, 1905.

It must have become obvious to the philosopher, that an hitherto unknown world was being unravelled in these discoveries and that under certain conditions bacteria are the enemies of mankind. Whatever the ultimate place of bacterial life in the grand scheme of things, from now on it can no longer be said that Nature is good and merciful. If there is a purposiveness in the various elements which constitute Nature and Life, in this instance at least, in so far as man is concerned, it seems like a nefarious purposiveness.

Internal Secretion: Singer in his prologue assumes that, "Mind holds the reins, and at a certain point mind pulls the reins, and the important question is, where that point may be." Let us apply this proposition to the problem of internal secretion.

Present-day evidence indicates that goiter occurs subsequent to a chemical disturbance and this change involves iodine impoverishment. Here then, it would seem, is a disease, brought about by chemical disturbance, and manifesting itself in one of the ductless glands. When the disease is well developed, certain changes in the psychic and spiritual life of the individual become manifest. The patient loses his normal mental balance, the psychic life of the individual becomes abnormally sensitive, or insensitive depending upon the stage of the disease. At times more idealistic and more imaginative; sometimes for good and sometimes for evil. Here is evidence of matter such as iodine and thyroid gland, controlling the mind of man.

Let me also mention the lack of intelligence in the cretin and the minimum of mental life in the adult hypothyroid. You well know the effects of castration on body and mind, and you know what pituitary disturbance does to body and mind. I deal here with no theories, no fanciful pictures drawn by the artist endocrinologist, who tries to show the controlling effect of endocrines over the mind and destiny of man. These that I speak of are positive objective truths. It is over such chapters in the story of science, that scientific materialism chants its song of self-praise, and perhaps not undeservedly so.

Physiology and Biology: Pavloff's (1849–   ) important contributions to physiology and indirectly to psychology are everywhere recognized. Many instinctive and subconscious reactions, formerly unexplainable except as evidences of vitalistic processes, are shown by Pavloff to be the result of "conditioning" of the animal. In the last analysis this means that what we consider subjective, from within us, today, is in truth only the objectivity of yesterday.

Jacques Loeb (1859–1924) enlarged the viewpoint of the biologist and psychologist and in many ways extended the field of physiochemical science. He showed that he could fertilize the egg of the sea urchin, and the frog could be artificially fertilized with a chemical solution (valerianic acid in sea water) just as sperm does it naturally. Other experimenters fertilized the egg by mechanical means. Loeb's experiments with sea urchins led to the belief that if this problem were sufficiently studied, physiology and chemistry would yet create an organic machine. Fertilization by chemical means was surely a surprise to vitalism. Occurrences which were heretofore considered evidences of vitalistic phenomena were shown to be due to physiochemical action.

Carrel (1873–): The work of Carrel is of the utmost significance. Virchow, with his cellular pathology, claimed that the animal economy is a state, and each cell is a citizen. Carrel, as biologist, showed that a single cell may be transplanted, and under conditions favorable to life and growth, will live and multiply extravitally. Cells of the chick embryo, thus treated, are now living in cultures started about twenty-two years ago. It has also been shown that these cells when grown in the blood of the young chick multiply abundantly: indicating that the fountain of youth is in youth itself. When the cells are grown in the blood of an old hen they grow slowly or die. Carrel also showed that life may be suspended: that removed sections of arteries may be preserved by freezing, for weeks, and then be successfully transplanted into living animals.

Carrel's superb experiment, however, was the eviscerated organism. Removed from the carcass of an animal, placed in a glass tank in a chemically correct solution at body temperature and under certain pressures, the lungs breathed, the heart beat, digestion occurred in the digestive tract, and the kidneys secreted urine. Regardless of the carcass and brain, the organic functions, the vegetative functions continued, and life at the lower level was carried on. Without brain, mind or the driving force which could come from them, life went on for days. Such has been the progress of physiology and biology and thus, one by one, various phenomena of life are coming to be better understood.

Physics and Chemistry: With the discovery of roentgen ray in 1895, Becquerel rays in 1896, and radium by the Curies in 1900, it was learned that radioactive substances render the surrounding air a conductor of electricity. This radiation is in the nature of electromagnetic momentum. It is now known that the energy involved in radioactive change is several million times greater than any known chemical action, and is open to calculation. At the present time it is believed that matter gives up to space or to the electromagnetic field the energy stored within it. Matter (gasoline in the tank), is an accumulation of energy in a circumscribed region of space. Energy (exploding gasoline in the cylinder), is matter in transit.

Thus newer discoveries have led to a new conception of matter. After three thousand years, we may at last be forced to give up the law of Anaxagoras which predicated that nothing originates, nothing is destroyed. Some physicists believe that heavier atoms are being constantly built up out of lighter ones; others hold that matter is destructible and transmutation and disintegration of matter do occur, and that the atom does disintegrate, at least where there is radioactivity. This school of physicists proclaims that nothing is created, everything is lost. It is a very slow disintegration, but a sure one. Radium disintegrates into lead and helium. Present-day calculations estimate that one-half of a given mass of uranium will be transmuted into lead in four and one-half to six billion years. Even this, it may be, is only the fragment of an eternal moment, who knows?

Thompson, 1897, discovered electrons in the atom, and Rutherford in 1911 distinguished the proton.

Electrons are a constituent of all matter. Electrons are negative and protons carry a positive form of electricity. Electrons are waves, just as *x*-rays are waves. The biologist and the physicochemist work with the thought in mind that all of life may be considered as a physiochemical process. There is no doubt but that a human thought is accompanied by physical changes in the brain. As there is no energy without matter and no matter without energy, is it too much to believe that there is no soul and no mind without the body?

Matter, space and time are Nature's inseparable trio.

Says Eddington: "The atom is as porous as the solar system. If we eliminated all the unfilled space in a man's body and collected his protons and electrons in one mass, the mass would be reduced to a speck just visible with a magnifying glass." Thank the gods for this one speck.

Einstein: Newer philosophies are based on recent advances in science. Philosophy follows science. We listen to Einstein the philosopher, because Einstein the scientist has propounded what is up to the present time the incontrovertible theory of relativity. To Einstein as well as to Newton there is no absolute position and motion; both are relative. We ought to weigh carefully the thoughts of one who has attained sublime heights in thinking. Einstein rejects the idea of personal immortality; he believes that life ends when the subject, by his actions, no longer affects his environment. He believes that everything in the universe is determined by natural laws, and that the cause of all causes is too involved for the human understanding of today.

Bertrand Russell discards the antithetic views of mind and matter, with all the authority of a twentieth century scientist. He suggests that mind and matter both are composed of a more primitive stuff which is neither material nor mental. Since the quanta theory of Bohr and the studies of Max Planck, it is denied that energy and matter are separable. Radiation is now looked upon as material projectile. Radiation possesses structure. Recent observations indicate that atoms act like waves when projected from a crystal; behaving like reflected sunlight, rather than particles of matter.

Russell speaks in terms of the latest discoveries in science. Matter is a form of energy, it is composed of electrons and protons, and these are a series of events, radiations and waves. The electron cannot have velocity and position at the same time.

Electrons and protons, like the soul, are logical fictions; each is really a history, a series of events, not a single persistent entity. Mind is a mental event, or a group of mental events, which form the history of a living body. We know that the brain is not immortal and that the organized energy of a living body becomes demobilized at death. It is rational to suppose that mentality ceases when bodily life ceases. That the soul is something quite apart from the living body is a metaphysical superstition. [Russell looks upon immortality as nothing more than a wish to prolong life.] Immortality finds no support in Science. Vitalism, as a philosophy, shows a lack of sense of proportion and logical relevance.

If Russell speaks better and with greater authority than preceding philosophers, it is because he sees life through the eyes of one who has taken part in the advancement of science and one who understands the imputations of science.

Haldane speaks as a scientist and philosopher. He denies immortality, saying that consciousness depends upon physical and chemical actions of the brain, and mind does not continue without brain. Mind is not a mere by-product of matter, though its limitations are largely due to the body. Haldane sees no human progress without science, deplores those institutions which interfere with scientific effort, and believes that two hundred years of scientific determinism are still necessary if an enduring civilization is to be established. Einstein believes that thousands of years will be necessary for the realization of a Superman.

If I have been at all successful in my effort to correlate a few of the very many ideas of philosopher, scientist and physician, you will have gathered certain impressions concerning the trend of thought in the succeeding periods of history. There are times when one is inclined to believe that the metaphysician and philosopher have contributed as much confusion as clarification to the sum total of present-day knowledge. It is clear that philosophy has been helpful to the extent to which its premises were based on enduring knowledge. When pseudo-science has fallen, philosophy based on such science has likewise fallen.

As I see it, the vitalist of old holds his position largely because science is unable to prove all the necessary claims. When carefully considered, the position of this vitalist is really that of a great negation. The scientist, the realist, having provided most of what is actually known, admits his limitations unhesitatingly. Of the two, the scientist, the doer of things, is the true optimist. He knows the joys of contemplation and comprehension and at times he is fortunate enough even to realize his life in action.

A close-up of Aristotle's Entelechy reveals some startling things, startling because so much has been predicated on this philosophy. Aristotle held that Nature produces nothing in vain and that every natural action has a certain object.

I wonder by what right Aristotle assumed that Nature produces nothing in vain, or that every natural action has an objective, or that one thing exists for another? Could Aristotle have realized the immensity of the universe and the relative insignificance of Man in the Universe?

Man may rationalize that everything is for him, but is that not because of Man's innate and inherent egocentricism? Aristotle assumed that certain things are so, on the assumption of other assumptions. This is the Vitalism, and Entelechy of Aristotle, and on such metaphysical grounds we are asked to doubt and question the reality of science. Was it not Aristotle who said, "Dear is Plato, but dearer still is truth"?

Throughout Nature we see variation and variegation. It is not always clear that the variegated accumulations in Nature have come in response to special needs. The red tail of the tropic bird in Polynesia is not necessarily the expression of a need for a red tail, it is an occurrence, the product or by-product of a set of local conditions. Man's brain and his mind may represent nothing more than a development, the result of certain stresses. Nature, being rich in raw materials, has, within certain limitations, permitted development of the human brain. Experience and memory engraved on brain cells permit comparisons of stored memories. The greater the interaction between memographs, the broader is the scope of mind and intellect. Man has memory, the dog has scent, the carrier pigeon has sense of direction. Each is a special development. Why grant more meaning to the poetic fancy of man's mind, be it esthetic, moral or religious, than to the direct flight of the carrier pigeon on his distant and uncharted homeward journey? Is our social organization, with its aim at perfection and equality, of greater import to the universe than that of the ant or the bee? Who knows? There is much of the chanticleer in Man.

One thing against which Man should guard himself constantly is his own egocentricism. Man looks upon the world and universe with the same mind that he looks into his own life's experience, into his own ego. His anthropomorphism, his myopia, becomes a menace to clear thinking. Man, being weak, has not the courage or the clarity of vision to cast off his race memories, the traditions of his history. If, as Aristotle believed, the variety of things on this earth is the result of an Intellectus, of a design, then Entelechy or Vitalism implies a certain fatalism, an unalterable destiny for things.

Why inject destiny into the situation? Do we know enough, do we have the necessary corollaries upon which to predict a destiny? Upon what grounds are we justified in such an assumption, be it the destiny of a man or humanity? Who knows that the human race or earth or universe has a destiny? Does not destiny imply certain occurrences within a period of time? How much do we actually know of time, and when will entropy and equilibrium be reached? When is the nadir hour?

If the quanta theory negates the cause and effect of things, does it not likewise efface the design of Aristotle?

Vitalists have said that the best that science can do is to draw mathematical pictures, and that scientists portray the creator as kind of a superlative mathematician. It is man who is the mathematician, the universe is reality. Man finds that for him mathematics reflect the processes of Nature better than the other available sciences.

Whitehead believes that the whole concept of materialism only applies to very abstract entities, the products of logical discernments.

Let us see how far we may apply this thought. Let us suppose that $CuSO_4$ and $C_6H_{12}O_6$, as chemical formulas in themselves, are abstract entities, and also that their chemical structures may be classed as logical discernments. Is it not true that if we know anything at all, we know that copper sulphate and glucose are realities and when they are mixed and heated in solution, a very real change takes place? The resulting product proves the first two substances and also the third substance which is newly created. Thus we see that abstract entities and logical discernments mirror the behavior of great realities, but do not replace them.

There are times when one is driven to the thought that the whole concept of vitalism betrays man's metaphysical groping for a something which might permit him to retain and cherish the idealism of prescientific days, of his anthropomorphism. Man, having his feet on earth, insists that his head reach to the clouds. The Franciscan friar, guiding us through the catacombs, said that he lives on vegetables by day and dreams of meat by night.

Man's imagination and his dreams are the most wonderful things on earth or in heaven. Fortunately for us, most workers in science do not feel the need of a vitalistic theory, of an umbilical cord, to tie them to the universe. The scientist feels that he is an integral part of the universe.

The scientist, contemplating the universe from his own minaret, admits that there is yet too much that is unexplainable in the mechanistic theory of life, and that his conception of Nature is incomplete.

He realizes that he has not yet gathered materials with which to construct protoplasm and that certain fundamental criteria in life and ultimate reality are beyond his understanding. He willingly assumes that man and his mind are an infinitesimal part of Nature, and that the laws governing Nature likewise direct and govern him. But that does not imply that all that man has uncovered with Science has suddenly become worthless and that order in Nature is a mirage. We have very good reasons for believing that there is certain unity in plant and animal protoplasm, that organic life and inorganic life obey the same laws and in so far as Nature is understood they are fundamentally alike. Science sees that underlying Nature there is a great continuity. There are catabolism and anabolism on all sides; and the whole is a great continuation rather than an endless series of single events and their causes. The twenty-six letters of our alphabet have no design or purpose in themselves. They have the materials, however, with which to express man's highest aspirations. They may also be scribbled on a scrap of paper in such a way as to let loose enough perversity to inflame and destroy humanity. Nature is far more rich in raw materials than the alphabet is rich in human possibilities. What man really needs, is a master key to Nature.

Thus, knowing what we know and having at the same time a keen awareness of our vast ignorance, shall we be hesitant in facing the unknowable and hide under the cloak of a supernatural vitalism? If we take vitalism too seriously, if it becomes for us a port in the storm, is it not likely that the research worker will take a scientific holiday, and, enjoying his levity and his freedom, will forget to come home, until after his fires have gone out and after it has been dark, perhaps for ages? Shall we therefore embark upon a vitalistic sea of doubt and uncertainty because there are no answers to questions concerning the ultimate nature of reality? Because we do not know why there is a universe or what it portends? Shall we allow what sometimes appears as the tragic sense of life, make of life itself a tragedy?

The student of natural science, or the physician who has come to a stalemate and in his hour of fatigue and ennui finds himself murmuring, "Quo vadis" should be invigorated by the words of Bacon, "Knowledge is power." It seems to me better if need be, to go down with Science while holding aloft the banner of youth and hope, than to allow oneself to drift toward an uncharted and unknown Nirvana.

A NOTE ON THE MEDICAL WORKS OF OLIVER WENDELL HOLMES*

By EDGAR M. BICK, M.D.

NEW YORK

IT is commonly assumed that the judgment of a man's true worth lies in the opinion of his posterity. The subject of this note must be considered an outstanding exception to this assumption. Oliver Wendell Holmes, Professor of Anatomy at Harvard University, exerted a tremendous influence on American medicine, and was for many years one of its leading mentors; but appreciation of his importance by American medical men has been woefully inadequate. One of the reasons for this is the relative paucity of his published work. We are his early posterity, and already it has become a bibliographical problem to find any reference to his medical life which, in importance to human welfare, far transcends his literary efforts. In an attempt to discover the basis for the position he occupied among his professional colleagues, we were surprised to find that his scientific attainments were of considerable importance, probably as great as any physician's in the United States up to his time. We were also surprised to see the very modern concepts which he anticipated and of which he must be counted among the original proponents. It was this which prompted a short note on the medical works of the author of "Old Ironsides." A small book, "The Bibliography of Oliver Wendell Holmes," by George B. Ives (1907) has been of great assistance, and we followed his lead for the more obscure material.

Among Holmes' earliest contributions was a clinical paper, "Facts and Traditions respecting the Existence of Indigenous Intermittent Fever in New England." This essay won the Boylston Prize for 1836–37. Although of local interest this contribution was of very considerable importance at a time when such fevers were being treated by medicos in the countryside for almost any febrile condition which came to their minds.

Another early clinical paper dated 1838, when Holmes was twenty-seven years of age and but recently returned from his European studies, was on "The Nature and Treatment of Neuralgia." This was read before one of the medical societies, but we have been unable to trace the journal in which it was printed. A third paper mentioned by Ives which was delivered about the same time bore the title, "How Far the External Means of Exploring the Condition of the Internal Organs is to be Considered Useful and Important in Medical Practice." These three papers are interesting because they show his early and soon to be lost application to clinical studies.

In 1842 he delivered two orations before the Boston Society for the Diffusion of Useful Knowledge, subsequently printed as his well-known essay on "Homeopathy and Kindred Delusions." It is not so well known that Holmes' interest in the subject was a source of constant reiteration and that it went beyond mere propaganda against the principles of Hahnemann. He was greatly concerned about the tendency, then at its worst, of extremely high dosage in medication. Doses of 3 drachms of calomel were evidently not uncommon. In several of his later speeches he deprecated the practice with great vehemence. While he believed homeopathy to represent an absurd reaction, at least in the matter of doses, he constantly warned the profession that moderation was necessary. This speech has always held an important place in the published medical essays. Most of its shafts made successful hits, and even today it can be read with great profit by merely adding several of our delusions to those he discussed and applying the same analysis to them. Dr. Fishbein has recently done exactly this, and his book has been rather widely read.

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* Presented before the Section on Historical and Cultural Medicine, New York Academy of Medicine, May 13, 1931.

In 1843 Holmes read to the Boston Society for Medical Improvement the paper on "The Contagiousness of Puerperal Fever," the one contribution with which his name is not infrequently associated. It was printed later in the *New England Quarterly Journal of Medicine and Surgery*, which, he laconically remarked, unfortunately lasted but one year. Nevertheless, it raised a magnificent storm of controversy which kept him enthusiastically occupied for many years. He, however, had grasped the significance of the doctrines later promulgated by Pasteur, Lister and Semmelweis, and fought ardently for their practical application to maternity welfare. In the preface to the third edition of his medical essays (1891) he said that by that time the problem had already become one for courts of law and life insurance societies rather than professional polemic. It seems today almost unbelievable that among his opponents were some of the leading figures in American medicine.

In the same year he was invited to review Elliotson's "Principles and Practice of Medicine" for the *Boston Medical and Surgical Journal.*

For a short while after this there are no papers to be found or scientific lectures on record other than those in the classroom. In 1847 he took the chair of Anatomy and Physiology at Harvard and soon after the results of his scientific work again appeared. About this time, under the leadership and due to the original work of Bichat in France, the theory of cellular structure propounded somewhat earlier by Schwann came to be applied to the study of anatomy. Out of this developed the study of the general anatomy of tissues rather than of organs, later becoming the science of histology. Holmes, ever in the vanguard of medical progress, took up the cudgels for the new subject. One of the chief causes for the advancement of this branch of anatomy was the then recent discovery of the compound microscope. This instrument became a centrum for research at Harvard and under Holmes' encouragement his fellow workers applied themselves to it. Four papers were written by him between 1852 and 1860: "Microscopical Preparations" and "A New Stand for the Compound Microscope," were published in 1853 and 1857 respectively in the *Boston Medical and Surgical Journal.* "On the Use of Direct Light in Microscopical Researches" and "Reflex Vision" were printed in the *Proceedings of the American Academy of Arts and Sciences.* These four papers are of very great interest because they represent a tremendous effort on the part of Holmes, most of which did not come to print, to popularize and advance a new step in medical research. How many papers by his students and assistants were the result of his instigation can never be estimated. He left to others the detailed investigation of the newer truths which his mind instinctively grasped. In this lies the secret of the lack of appreciation given his scientific importance.

In 1860 he delivered his famous address to the Massachusetts Medical Society, bearing the title "Currents and Counter-currents in Medical Science." This is one of the finest discussions of the philosophy of medicine ever written, and it is as alive today as the day in which it was read. In this paper, among the many phases of practice which are discussed he mentions "the inveterate logical errors to which physicians have always been subject." Of these errors his attitude toward the *post hoc propter hoc* fallacy is exquisite. He defines it "assuming a falsehood as a fact, and giving reasons for it." One of the most remarkable paragraphs in this essay, remarkable because it foreshadows a conception which we today are just beginning to appreciate, is the following:

> Many affections which art has to strive against might be easily shown to be vital to the well-being of society . . . They are really not so much diseases as manifestations of congenital incapacity for life; the race would be ruined if art could ever learn always to preserve the individuals subject to them.

From 1860 on there appeared numerous addresses and orations dealing with medical education, medical libraries and medical history. In education he advocated the scientific training of students and, above all, and this before Osler's day, he stressed the necessity for bedside instruction. He had the Hunterian method in teaching: observation, accurate and repeated. Even though he himself was a brilliant lecturer in anatomy, he insisted upon the inadequacy of verbal instruction without specimens or patients.

Holmes was an ardent advocate of the movement to establish medical libraries, and to this he gave much serious thought. Collections of books were not enough; there had to be proper cataloguing and above all adequate indexing of periodic literature. This insistence upon the necessity for practical classification was an important influence in the establishment of our present quarterly index. His own vast knowledge of medical literature enabled him to repeatedly astound his colleagues by references to earlier reports on matters they believed to be entirely original. He was finally influential in establishing several such libraries in Boston and elsewhere, and he was always sought in consultation when plans were being laid.

It was in the field of medical history that some of his best work was done. Garrison says that the "Medical Essays" of Holmes was easily the most important American book dealing with the history of medicine up to its day. He appreciates that fact by liberally quoting from it, particularly when discussing the important medical personalities of early 19th century Europe with many of whom Holmes had had personal contact during his European student years. In addition to this well-known volume other valuable contributions to early Americana appeared in various periodicals during his lifetime. A paper on James Jackson (1777–1868), the first physician to the Massachusetts General Hospital, appeared in 1867, a year before his death. In 1862, Holmes published "The Medical Directions Written for Gov. Winthrop by Ed. Stafford of London (1643)." This was published in the *Proceedings of the Massachusetts Historical Society*. The Jackson paper and another short one on "The Late Dr. Elisha Bartlett" appeared in the *Boston Medical and Surgical Journal*. Two other similar articles were written, one on J. Mason Warren, and another on Jacob Bigelow.

In his general medical writings and in lectures to students historical references abound. A sentence of his appearing in the lecture on medical libraries, delivered at the opening of the Medical Library of Boston in 1878, might serve as the text of any university course. "There is a dead medical literature and there is a live one. The dead is not all ancient and the live is not all modern." His own extensive knowledge of medical books from Athens through London and even early New England, and the excellent library which he personally collected were evidence of his ascription to that doctrine.

In spite of the color of its banner, the name of Harvard has not been frequently associated with radical proclivities. Yet during the 19th century, Holmes, one of its leading spirits, became the focus of many criticisms, both scientific and social, because of his constant championship of new ideas. He considered it his duty to combat "that great property of mind as well as matter, inertia." Against what he believed to be reactionary traditions in medicine he leveled his most powerful weapons. We must recognize that the period in which he lived was as fast and furious in its intellectual activity as is our own; in fact the necessary alterations in human thinking were more profound. His century witnessed the introduction of pathology, histology, bacteriology, applied electricity, organic chemistry and modern surgery. Holmes lived a long life through these revolutions and in America he stood as the whip which drove back the objectors and allowed the modern scientific concept of medicine to gain entrance. Once inside its borders he encouraged, cajoled and persuaded his colleagues to apply themselves to their investigation. He himself during the '60's published results of his own work. His path was not easy. Traditions in the medical fraternity in this country, with few brilliant exceptions, were strongly opposed to him. In the end, however, he was honored as few others have been. He saw most of his battles won, and his influence on the profession felicitous. This influence was an important factor in the great advance made by American medicine in the second half of the 19th century and as such has earned a niche in our medical history which is as yet greatly undervalued.

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THE LIFE AND TIMES OF DR. WILLIAM HARVEY

By SIR WILMOT HERRINGHAM, K.C.M.G., C.B., MD., F.R.C.P.

HAMSTEAD, ENGLAND

PART IV*

VI. THE COLLEGE OF PHYSICIANS (CONTINUED)

The prospective candidates had three oral examinations before the Censors, and a fourth, probably formal, before the College, before they were admitted. Thereafter they were summoned to the College Comitia, and could be fined two shillings, like the Fellows, for absence. They were usually elected to the Fellowship in order of their seniority.

Those physicians who received merely a license to practice were called Licentiati, or more commonly Permissi. They, too, underwent an oral examination before the Censors, and in one or two cases the details are recorded in order to satisfy the magnates who had recommended them that they were justly rejected.

Thus Thomas Lambe, strongly recommended by the Bishop of Durham, was asked where he was educated, and given a piece of Latin to translate. He replied that he did not know Latin, and did not pretend to any knowledge of Medicine. As he was a notorious astrologer he was asked a question or two in astrology, of which he showed entire ignorance, and also a simple question in surgery with the like result. When questioned about his large practice he said he could not help people coming to him, and that all he did was but "trifling and babbling to get a little money."

A man called Boett was examined in 1632. He was asked if he had read Galen de inaequali intemperie. Yes. What did Galen mean by the term? He did not know. Where were the humours generated? In ventriculo. Does not the liver take part? Yes. But the liver is causa univoca and so would produce effectum univocum (i.e., would not generate all the four humours). No answer. In how many ways are the bones connected? Two. How many kinds of joints are there? "Plane ignorabat." What change did "pituita" undergo in the ventricle? Did it get thicker or thinner? Thicker. Then how did the ventricle get rid of it? "Monet Doctor (the examiner) fieri crassiorem." Referred for further study.

This record is interesting because it shows that Harvey's discovery had not yet been accepted by his colleagues or they would not have asked such questions.

Country practitioners also came up to the College in order to obtain the credit of the license. Many of them had not the M.D. They had a single oral examination before the President and three electi.

Letters testimonial were issued to successful candidates, according to a statutory form, and there is also a form of letter to be written to corporations stating that X.Y. practicing in their town is not a licensed practitioner. The College evidently tried to support its licentiates against their rivals in the country, as well as in London.

The obligation to obtain a license from the College for London practice extended to everyone, even to an M.D. of Oxford or Cambridge. A good deal of ill-feeling existed at the universities on this account, and when in 1621 their cooperation was asked in getting the new charter through Parliament and opposing the petition of the surgeons for the right to administer medicine internally, they consented for the latter object, but refused for the former. Gulston and Baskerville canvassed the Oxford graduates without success, Harvey, Clement and Wilson, the Cambridge men.

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Fig. 4. Leiston Hall, near Saxmundham. Property of Daniel Harvey. Photograph by the Author.

With these powers it would be thought that the College would have little difficulty in putting down ignorant practice. But it was not the case. Almost every week complaints came before the Censors, offenders were summoned, fined and imprisoned, and yet the abuse went on.

The prevalence of quacks is mentioned by Burton[35] in 1621:

> Now for physicians there are in every village so many mountebanks, empericks, quacksalvers, paracelsians (as they call themselves) *causifici et sanicidae* (so Clenard terms them), wizards, alcumists, poor vicars, cast apothecaries, physicians' men, barbers and goodwives, professing great skill, that I make great doubt how they shall be maintained, or who shall be their patients.*

Quacks were supported by great persons from the King downwards. One of the most ignorant produced royal letters, another claimed to be the King's surgeon, and before the College could prosecute him it had to obtain leave from the Lord Chamberlain. Judges, bishops, noblemen and noble ladies including the Queen, wrote asking that this or that man might be admitted to practice, and the College with great courage replied that on examination he had been found too ignorant to be admitted.

Others were druggists who prescribed, some were tradesmen without any knowledge at all, and many were women.

* Sir G. Newman quotes this passage in his pamphlet on Sydenham, 1924, but omitting the first three words, refers the difficulty of maintenance wrongly to the quacks. It really refers to the physicians.

Death was frequently ascribed to this kind of practice, and in some such cases the Censors advised that the matter was "too high" for them and should be taken before the Courts of Law. One man twice tapped the abdomen. Both patients died. He was a shoemaker.

The drugs commonly used by these people were either violent purges, or mercurial ointment. One complainant, who is but one of many similar, stated that his sister being troubled with shortness of breath, sent for the accused (Boett) who gave her what he called a gentle purge, which acted so violently that at midnight she appeared to be sinking. She died a day or two later having suffered intolerable pain all the while. Another quack when asked what was the disease for which he treated the patient "sayed it was such as he neither dare nor will expresse."

The College was often defied and sometimes apparently with impunity. One druggist, charged with making up prescriptions for a notorious quack named Butler, defied the College and its warrant, saying it was "not worth three skipps of a louse." Such offenders were discommoned and Fellows were forbidden to deal with them.

Sometimes the College took it upon itself to decide upon a complaint of overcharge, and there are two cases in the Annals in which the charges of medical men were found to be excessive.

In 1637 a man called Leverett was sent to the College by the Star Chamber. Clowes, the King's Serjeant Surgeon, had complained of him for pretending to cure the King's evil by touching. He said he was the seventh son of his father, but did not pretend to any virtue on that account. The College had several meetings, giving him patients to touch, and examining others whom he brought himself. They also examined the parish register at St. Clements, Eastcheap, and found that he was not the seventh but the fourth son of his father. Their verdict was that he was an arrant imposter. He had been by trade a gardener.

The College was by its own statutes forbidden to license anyone who was in Holy Orders. A clergyman named John Burgess, a Cambridge M.A., who for conscientious objection to ceremonies had given up his cure, and had obtained his M.D. at Leyden, was refused a license on this account in 1612. The sequel is curious. He at first practiced outside the limit, but subsequently conformed, took the living of Sutton Coldfield, and became a prebendary of Lichfield, and in 1634, as incumbent of Sutton Coldfield, he was examined and given a license to practice in the country. In the letters testimonial he is described as "venerabilem virum" instead of the usual "probum."

A similar laxity appears in the matter of "Papists." The question was once raised whether they should be examined as they could not legally be licensed. But in 1626 Parliament asked for the names of papists in practice, and a list of 13 physicians and 5 apothecaries was returned. This probably reflects the reluctance of the College to carry out the bigoted laws passed by Parliament. Cademan, the Queen's physician, was a papist.

In 1618 a Dr. Moore offered £20 to the College asking to be admitted to practice. It was said by some present that he had been inhibited by the Archbishop (Abbott) to whom a letter was written. The Archbishop replied that he heard "that several who do not conform either from a Puritan vein or from Popishness," try to obtain admission to practice. He begged the College not to admit or license either sort. Dr. Moore was not admitted to examination. He subsequently wrote that the gift was an expression of respect and asked the College to accept it as such. If Dr. Moore had, like Dr. Burgess, been in Holy Orders, the College would without reference to the Archbishop have refused to examine him. He was probably a Roman Catholic, and in 1620 a Dr. Moore was arrested on suspicion of being a Catholic priest but was acquitted (*C.S.P. Domestic James 1*). A Dr. Moore was physician to Buckingham in the Rochelle expedition (*C.S.P. Dom. Charles 1. 1627*). This is probably the same man.

A surprising number of foreigners were practicing in England in the 16th and 17th centuries. Among the six physicians to whom Henry VIII granted the original Charter was Fernando de Victoria who, with Linacre and Chamber, was physician to the King. The unfortunate Lopez, executed on what seems to have been a false charge of attempting to poison Queen Elizabeth, held the same position under her. James invited Theodore Turquet de Mayerne, a Frenchman, to be one of his Physicians in Ordinary, and he held the same post under Charles I. The father of Sir Julius Caesar Master of the Rolls under James I had been Dr. Caesar Adelmar, a Frenchman, in practice under Queen Elizabeth. Dr. Matthias Holbosch, a German, who died in 1629, had been practicing in England for fifty years, and left 680 volumes to the College library.

A large number of foreigners appear also in the lists of those prosecuted, and a few among the "permissi," who were not a numerous body. In 1632 Winston, a Fellow, complained of the number of foreigners in practice, and it was found that there were three Fellows, one Candidate, the younger Hamey, afterwards a great benefactor to the College, and six Licentiates, as well as twelve who were unlicensed. The number of foreigners was probably due to the want of medical education in England. One of the foreign Permissi, Dr. Deodati, licensed in 1617, was an obstreperous person whose record is amusing. He was called up in November, 1621, for defaulting in his yearly fee of 40 shillings, when he was very insolent, put on his "galerum" (the official cap of his Leyden degree) and left the room. He apologized a month later. In 1622 he attended a case with De Laune, a Fellow, would not obey his orders, and when questioned called De Laune a "Coquin macé."* For this he was fined, but failed to attend three meetings of the Board, and on the fourth occasion wrote that he was too busy to waste the afternoon "in futilibus et puerilibus λογομαχίαις." No more is heard of him till 1626 when he complained that, though the College has had £23 of his money it does not do its duty in protecting him from quacks, and has been of no benefit to him. The President pointed out the exemptions from public duties which the licence gave him, but at the end "all we could gett of him was at parting Well Well." In 1632 he was reproved by the President for taking a seat among the Fellows at a Comitia, whereupon he abused the President for insulting him.

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* A proverbial phrase of abuse. Cp. "Je suis presbtre Macé." Rabelais. Gargant. Ch. v. The editors of Rabelais however know neither what the phrase means, nor to whom it refers.

He came of an Italian Protestant family settled at Geneva. His brother was professor of theology there, and his son, Charles, was Milton's greatest friend. He, himself, in 1609, was at Brentford, and physician to Prince Henry and Princess Elizabeth.

Sometimes an offender was protected by an Embassy. Dr. Jaquinto, a Venetian attached to their Ambassador, was frequently accused. On one occasion his treatment of a fever case was condemned, and he was fined, but as a favor to the Ambassador the fine was remitted.

Sometimes a man who was not a quack was brought before the College for mala praxis. A surgeon called Cooke had given Countess Bohun a bolus containing ½ oz. of cassia and ½ oz. of manna, and Mercurius dulcis for five draughts. She died of diarrhea. Cooke was bound in £100 "not to practice fluxing by Mercury, to acknowledge his ill practice to Lady Knyvett, and to bring back a testimony from her that he had confessed the same." He did so, and Lady Knyvett wrote to the College thus:

> My good friends,
>
> I understand by this bearer Thos. Cooke hee is by your command in custody of a messenger for some occasions best known to yourselves, upon which you have enjoyned him to repayre to me to make submission, which accordingly he hath freely and fully done with much sorrowe, and for my part I remitt and forgive all offences to me and desire with your favours he may be freed; and soe wishing you all happinesse, I rest,
>
> Your loving friend,
> Ka. Knyvett.

The fee for Candidates and Licentiates alike was £11.3.4 with a yearly subscription of £2.0.0 after the first year, when it was £4.0.0.

On election to the Fellowship the Candidate paid a further fee of £5.11.8. He also provided wine and sweetmeats to the Fellows present (*poculum charitatis praebuit sociis cum tragematibus pro more*).

After 1640 this fee was doubled.

In August, 1614, the College met for the first time in its new buildings at Amen Corner. But it was burdened with a large debt which appears not to have been discharged until 1633 when the lease was at last placed in the chest. During that time repeated appeals for subscriptions were made to Fellows, Candidates and Permissi. Gulston lent £200 on mortgage, and Harvey and Atkins gave £20 each which were much the largest subscriptions.

Rules for the Library were drawn up in 1632 by a Committee of which Harvey was a member, and in 1634 "Dr. Harvey hath given the skin of the man tanned for a monument to be preserved in the College."

It was the custom for the College to have a formal dinner every year. This is now held in Commemoration of Harvey on St. Luke's Day, and is partly paid for by his gift of land in Burmarsh, of which a yearly dinner was one of the objects. But when Harvey was elected the provision of the dinner was the duty of a Fellow who was chosen, apparently by the President and Electi, for the year. Harvey was made Fellow in 1607, was selected to give the dinner in 1610, failed to do so, and in 1611 (Palm Monday Comitia) was fined £6.13.4 for his default. In 1615 it was held for the first time in the new buildings at Amen Corner.

In 1617, the College being considerably in debt, it was resolved that the fine for the dinner should be £20 in future, and in 1622 Dr. Collins was fined that amount for default. But the year before the dinner had been paid for by a general subscription. In 1627 Ramsey pleaded poverty, and was ultimately let off for £8 on the recommendation of four arbitrators, two acting for the College, two appointed by himself. In 1631 Dr. Clarke begged to be let off for £15, but the College insisted on the full amount. In 1632 Dr. Wright paid £20 to be excused, and the dinner was held by a subscription of five shillings a head. Again in 1634 Dr. Read pleaded poverty and was allowed to pay a fine of £10, but with the proviso that to the subscription dinner of five shillings a head he should contribute his own subscription and a buck. The full fine of £20 was often exacted later.

Beside the Lumleian Lecture (see Pt. II, p. 251) to which Harvey was appointed in 1615, there was another Anatomy Lecture which, from the record of those appointed to give it, seems to have been held once every two years. In 1632 a second appears to have been founded and Dr. Gulston, on his death in 1635, left £12 yearly to endow what is called an Anatomical Lecture, but was evidently pathological, for the first subject chosen was, "The diseases of the nether bellye." Goddard was appointed the first Lecturer.

It was difficult to get Lecturers. The President nominated a Fellow, for no one would volunteer, and he was fined £4 if he defaulted. But in 1637 the fine was raised to £20. In 1638 the President was obliged to appeal to the Fellows to apply themselves to dissection with their own hands that the College might not be dependent on strangers to give Anatomical Lectures, and this in Harvey's College!

In 1631 the custom began of presenting and recording the College accounts in the Annals. The "pes computi" or net income was—

October 1631	£144.16. 5
October 1632	78.18.10
November 1633	152. 0. 0
October 1634	268. 0. 0
December 1635	165.16. 7
Plague. no comitia from June 25 1636 to Jan: 13 1637	
May 1637 Deficit	£ 73.18. 3

After this date there is no further entry of the kind in the Annals, and the Treasurer's ledgers are no longer in existence.

In 1614 the College was rated by the City "pro armis parandis et gerendis." Against this the College appealed, and Sir William Paddy argued the case successfully before the Lord Mayor, the Common Council, and the Recorder Sir Henry Montague (afterwards first Earl of Manchester).

In 1627 the College was again rated for Ship money, and Harvey and Fox were deputed to take the Annals to the Recorder, and show him the precedents, while Mayerne was asked to see Conway, the Secretary.

In 1634 the petition of the College about arms and ships was heard by the Lords (of Council) but refused.

In 1641 Parliament raising money ostensibly for the King's service assessed all Doctors of Civil Law or of Medicine at £10 a head (Somers Tracts), in 1642 four-fifteenths were demanded on the College buildings, and in 1643 the College was ordered to pay £5 a week as part of the assessment levied on the City.

The College was occupied from 1616 onwards in endeavoring to get its new Charter through Parliament. Harvey was one of the Committee appointed for the purpose.

In 1617 the midwives petitioned to be incorporated. The College, while not opposing, insisted that if incorporated they should be instructed and examined by the College. This petition appears to have failed. But in 1634 Peter Chamberlain, a Fellow who specialized in midwifery, made a fresh attempt. This time the midwives petitioned against him, alleging that he intended to make himself President of the proposed Corporation, and to usurp a position of authority over them. Chamberlain refused to submit his proposals to the College, which took the side of the midwives, and drew up a petition for them which they presented to the Privy Council. It was referred to the Archbishop and the Bishop of London who had hitherto licensed all midwives in London, and the College drew up a memorandum on the subject. The attempt at incorporation failed.

In 1621 the Surgeons petitioned to be allowed to prescribe internal medicines. The canvassing of Oxford and Cambridge already mentioned was successful in obtaining their help in opposing the petition. The matter dragged on till 1627 when the Surgeons' request was rejected. The Physicians claimed to be Surgeons as well as Physicians, had been expressly given the right to practice surgery by the Act 32, Henry VIII, and were the only part of the profession that had a university degree. The assumption of superiority which seems ridiculous now, was justified then by the want of education among surgeons.

In 1632 on a case of supposed murder referred to the College, the College in a Latin letter to the King advised that no seller of spices or drugs (*Aromatarius* or *Pharmacopola*) should be allowed to sell poisonous drugs promiscuously to women or the populace (*plebecula*), but only to those who were willing to give their names to the vendor, and did not refuse to answer publicly for the purchase, and also that they should not dispense medicine unless prescribed for by a doctor living at the time. The first clause anticipates the Poisonous Drugs Act of the present day. The Lords (Privy Council) asked for further advice, and the College developed it as follows:

1. No apothecary should dispense medicine without delivering the bills (prescriptions). If a patient brings the prescription of a physician who is dead he should set his hand to it.
2. Certain clauses should be inserted in the Apothecaries' Oath, and they should make all their medicines according to the authorized Dispensatory.
3. The drugs in the Dispensatory should be rated at a regular price.
4. No surgeon should trepan or perform a major operation without consulting a Physician.

In July, 1634, Harvey was deputed by the President to make a speech to the Apothecaries. He said that what the College desired in them was sufficient knowledge, honesty and reasonable charges. Subsequently the College undertook to examine their apprentices and these examinations appear regularly in the Annals. The College had applied for a Quo Warranto and the Apothecaries in 1635 professed their dislike of the policy of opposition pursued by the previous Master and Wardens and expressed their desire to agree with the College.

In 1618 the College published the first edition of the Pharmacopoeia or Dispensatorium, containing the remedies, external and internal, authorized for use, with the methods of preparation. It had occupied the College for four years. Harvey with seven other Fellows formed the original Committee set up in 1614, and several other names were added as time went on. The College was extremely strict in insisting that Druggists should adhere strictly to the preparations prescribed, and there are several instances of censure for alteration even of the flavoring materials. Fresh editions rapidly followed.

In addition to the discipline of the profession the College was consulted in matters of public health. In 1608 the King asked it to nominate four or more physicians to treat plague patients in the City for a competent salary. Six Fellows volunteered. Harvey was not present. Rules for dealing with the disease were referred to a committee.

In 1625 there was a bad attack of plague in London, Parliament was adjourned to Oxford in consequence, and 35,417 persons died of it.[36]

In March of that year the College drew up a schedule of precautions to be observed in order to prevent its spread, and on April 1 after a personal canvass of all Fellows present (*scrutinium a singulis peculiare habitum quod nunquam antea*) announced that four Fellows, Paddy, Argent, Harvey and Fox, who undertook on suitable conditions to visit and attend plague patients, would wait on the Lord Mayor (*Praetor*).

In 1630 there was a fresh panic, and a request was made from Court that the College would draw up regulations for prevention and cure of the disease. Harvey stated that when they did so before their advice was neglected, and the City magistrates would not admit the Doctores Stipendiarii, evidently the four who had volunteered if suitable terms were offered, to see the cases. A deputation of the Censors, and three others of whom Harvey was one, were appointed to explain matters to the King.

On April 9 a "libellus" or memorandum on the plague, drawn up by Clement the Registrar, was presented to the King by Atkins, one of his Physicians in Ordinary, and sent to the Bishop of London for license to print.

On April 20, on the motion of Harvey, who was himself under orders to go abroad with the Duke of Lennox, the President called for volunteers to attend plague patients. Two, Clement and Crook, offered to act if the conditions were suitable.

The President proposed the following:

1. A salary of £400 a year during the epidemic.
2. A pension of £200 a year afterwards.
3. A pension of £100 a year for the widow of any of the physicians appointed who might die of the plague.

Thereupon Clement and Crook withdrew their offer.

On April 20 the conditions were approved as suitable but there is no mention, then or later, of their being accepted by any one.

On March 26, 1631, an appendix was added to the "libellus" drawn up the previous year. It is headed "A copye of the Annoyances presented by the College to the Lords of His Majesty's Counsell by way of prevention from the Plague," and is a good paper in preventive medicine.

The "annoyances likely to increase the sickness" are:

1. Increase of buildings, leading to a crowded population by which "the ayre is much offended" and provisions rendered scarce.
2. Fumates, favoring spread within a house.
3. Uncleansed sewers, ditches and ponds.
4. Ditto. Streets and gutters.
5. Leastalls (dungheaps) near the City.
6. Slaughter houses in the City.
7. Burials of infected corpses in city churchyards which are already so full that even recent burials are dug up in order to make fresh room. They ought to be buried at a distance.
8. Funnels (apparently ventilating shafts) carried up to the top of houses from privies and vaults of the dead.
9. Rotting provisions, corn, malt, meat and fish.

The College urges the appointment of a commission or officer of health with sufficient power to discover these and other misdemeanors, and to punish offenders. It states that such appointments have been made in Spain and Italy and have been found of use.

In 1636 the College was again asked for a similar report, which was printed, published and dedicated to the King. Comitia were suspended from June 25 to January 13, 1637.

In 1627 the Privy Council asked the College to report on some alum works in St. Botolph's Aldgate which were complained of by the inhabitants. A committee of seven, of which Harvey was a member, reported that the works were a public nuisance, and they were ordered to be shut down.

At the end of that year the Privy Council applied again to the College for physicians "to attend the sick soldiers and sailors returned from the late expedition," that is Buckingham's disastrous expedition to Rochelle. Six Fellows were delegated for the purpose.

In 1628 the Privy Council wrote that the King had been informed that tobacco grown in England and Ireland is hurtful to men's bodies, and also injures Virginian trade. The College reported "that as it is now usually taken it cannot be but very unwholesome and hurtful, falling short of the perfection of other tobaccos that are brought from other more southern parts where it hath its natural maturity, vigour and efficacy."

Other functions also fell to the College.

In 1615 the unfortunate Lady Arabella Stuart died in the Tower after a long imprisonment in the course of which she had become insane. At the request of Winwood, the secretary, five Fellows viewed her body and certified that she died of chronic wasting disease aggravated by refusal of treatment and bedsores. Two cases of murder were also referred to the College; one, that of Reve, a servant of Lord Hereford, was before the College in 1625, but as the College did not meet, because of the plague, from June 20 to January 13 the following year, the inquiry is left unfinished. In 1632, Lord Holland wrote that a man called Cromwell had been convicted of the murder of his master Lane, but that he continued to assert his innocence and the King was anxious. The College heard evidence both on the drugs given and on the post-mortem appearances and eventually, in a Latin letter to the King, reported:

1. That the death was unnatural.

2. That it was due to caustic poison.
3. That there was no reason to suspect the draught given.
4. That the bolus given contained corrosive sublimate which is a caustic poison.

It thus fulfilled its proper function as an expert witness, and did not attempt to review the circumstantial evidence on which the accused had been found guilty.*

VII. THE HARVEY FAMILY

Nothing is known of this family of Harveys before the birth of Thomas Harvey of Folkestone, the father of William, in 1549. Mr. W. J. Harvey,[37] relying on the similarity of arms, traces a connection with Sir Walter Hervey, Lord Mayor of London in 1272. But the Folkestone Harveys apparently had no right to a coat of arms. The father is described as a yeoman in the certificate of William Harvey's admission into Caius College in 1593, and in the visitation of London, 1633–5,[38] the return of the family made "per me Eliab Harvey for my brother Daniel Harvey" is not accompanied by any coat of arms, which, as a note informs us, may be taken to imply that the family did not bear one.

The coat does not occur in the first three editions of Gwillim's Display, 1610, 1632, and 1638, but is given in the fourth, 1660, with a long and laudatory notice of the family.†

> Or on a chief sable three crescents argent by the name of Harvy and is the coat armour of Master John Harvey of Antwerp, Daniel Harvy of Combe Nevill in Surrey, Eliab Harvy of London, and Michael Harvy, esquires, sons of four of those seven Harvies brethren so eminent some years since in and about this city, the eldest of which was that profoundly learned Doctor William Harvy, the second, Thomas, the father of John abovementioned, the third* John, a member of the Parliament of 3rd November, 1640, the fourth Daniel, father of Daniel above-mentioned, late high Sheriff of Surrey,† who hath to wife the daughter of Edward Lord Mountague of Boughton. The fifth brother is Eliab Harvey of Broad Street, London, Esquire, the onely surviving of the seven, father of the Eliab aforesaid, which latter a while since married Elizabeth‡ daughter of Sir Thomas Witmore of Aply in Shropshire, Knt. and Bart, not long after his sister, Mistress Mary Harvy, had been marryed to Sir William Whitmore, Baronet, son of the said Sir Thomas. The sixth and seventh of these brethren were Matthew and Michael Harvy, twins, whereof the former dyed without issue, as also did the first and third,ā but Michael, whose widow is remarried to Wm. Steele Chancellour of Ireland, had issue Michael aforesaid, who hath late marryed the daughter of Wm. Underwood, Sheriff of London, 1652, which family is a hopeful and spreading ornament to this Kingdom.

William, his brother, is omitted.

At the College of Heralds, Lancaster Herald kindly showed me the arms, as described, of Sir Daniel Harvey, and a note attached states that they were granted "not before May 27th 1660." Young Daniel and young Eliab were both knighted at Canterbury on May 26. This is the only entry of a grant of arms to the family, and as the notice in Gwillim is previous to the knighthoods, for Daniel and Eliab are called esquires, it is clear that the Harveys had, as Sir D'Arcy Power suggests, assumed a coat resembling that of Lord Mayor Hervey before obtaining a formal grant. The practice must have been common, for the Long Parliament set up a Committee to inquire into it (*Journal House of Commons. Dec. 18, 1645*).

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* The authority for this section is The Annals of the College which are preserved there in MS.

† If it occured in modern times we should suspect it had been written to order.

* This is an error. John was the second son and Thomas the third.

† This refers to the son, not to the father.

‡ An error. Her name was Dorothy.

Harvey's mother died in 1605 and is the subject of a laudatory epitaph in Folkestone parish church. His father came to London after her death and died in Hackney, June 12, 1623. Fuller speaks of him as advising his sons as to investments in land, but this is improbable. There is no evidence that the sons were wealthy at this time. Thomas Harvey, his son, who died the same year, and was partner with the next son, Daniel, mentions no land in his will.

The father's will includes legacies to the children of one brother and three sisters, to his daughter, Mrs. Cullen, and her children, and to his grandsons, John and Daniel, the former the son of Thomas, the latter probably a child who died in infancy (the Daniel who survived was not born till 1631), and to his granddaughter Mary Foulke, daughter of his daughter Amy. The will begs the children to live in unity and to help one another, a request which they certainly fulfilled.

The seven sons of Thomas Harvey the elder were, William, John, Thomas, Daniel, Eliab and the twins, Michael and Matthew; his daughters were Sarah, who died in childhood, and Amy, who married William Foulke.

The second son, John, was in the Royal Household, but in what capacity is uncertain. In 1620 a pension of £50 is granted to John Harvey, "footman," on resigning his place to Toby Johnson (*Cal. S.P. Dom. James 1*). He was admitted a member of Gray's Inn, together with William, on March 14, 1625, and is then described as Serjeant in ordinary to the King. In the Household the title Serjeant, meant head of a department. The Household accounts are in Latin, and the Latin equivalent is Sirviens, often with the addition "et capitalis clericus" (chief clerk). But the accounts relate to the spending departments, wardrobe, stable, buttery and so on, and as John Harvey's name does not appear anywhere, this probably means that he held some office which was not in any of those departments.* On March 21, 1626, he was appointed Receiver General of Crown property in Lincolnshire, jointly with his brother Daniel, with survivorship. He was M.P. for Hythe in the Long Parliament of 1640, took the National Oath and Covenant in 1643, and died in 1645. During the Long Parliament he was ordered to pay his receipts to the Committee for the King's revenues, which applied them for Parliamentary purposes (*J. of House of Commons*, Oct. 21, Dec. 11, 1643).

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* In Nichols' Progresses of James 1 the Footmen are occasionally mentioned. They differ from Messengers, Quirries (Equerries) Gentlemen ushers and yeomen ushers, and they do not belong to the Bedchamber or the Privy Chamber. When the king's body was brought from Theobald's to Denmark House (Somerset House that was) for the funeral, most of the servants rode, but "the Footmen in black suites and velvet cappes and coates down to the knee, ran all the way about the body, not ranked, but in such manner as they do when the King removes." When gratuities are given during Progress the Footmen have the same as the Trumpeters and usually the same as the yeomen ushers.

He was one of the Grocers' Hall Committee, but of no other, and does not seem to have played an active part in politics. For the contribution of 1/20 levied in 1643 he was assessed at £500 on November 25, as John Harvey of the House of Commons, but on February 14, 1644, he seems to have been assessed again by mistake, as John Harvey junior, M.P. of Maryhill. A note to this last entry that he died shortly after payment shows that it cannot refer to his nephew of the same name, and there was only one John Harvey in the House at the time.[*] The account is confused, but John Harvey seems to have paid £100 in March, 1644, and then to have resisted further payment, for on August 9, the House resolved that Mr. Harvey, a Member of this House, pay £150 more besides the £100 already paid for his twentieth. His Executor was the younger Harbottle Grimston, and he left money for the support of William Foulke, son of his sister Amy, who was evidently imbecile and then in the care of Mary, Amy's daughter, who had married Robert West, and among other legacies £100 to William Harvey's wife, showing that she was alive at the time.

(*To Be Concluded*)

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[*] In Nov. 1682, Anna relict of John Harvey of Mary at Hill London took out letters of administration of his estate. This is perhaps the man whose name caused the confusion. Unfortunately no details are given.

(From Trattato di Christoforo Acosta Africano, Venetia, 1585.)

EDITORIALS

THE CADUCEUS

As an instance of the persistency of an error due to a lack of fundamental cultural knowledge the continued misuse of the Caduceus as a medical symbol is one of the most persistent, and in view of the contributions made by Garrison and other medical historians one of the most inexcusable. In a recent publication Stuart L. Tyson, D.D., of Pelham Manor, N. Y.,[1] gives a most authoritative and delightful summary of the subject.

Dr. Tyson points out that the term *caduceus* is the Latin adaptation of a Greek word which signified a herald's wand; originally it was a shepard's crook, a forked olive branch adorned at first with two fillets of wool, then with white ribbons, and later with two snakes intertwined, representing "the magic wand of Hermes, the heavenly messenger of the gods." Hermes was the son of Zeus and Maia, and his only connection with the healing art is that he is said to have been a half-brother of Asklepios, and to have married the latter's daughter Hygieia. Dr. Tyson discusses his various attributes with much humor and sums up the functions and characteristics of Hermes to show how inappropriate is the use of his emblem by physicians:

> As god of the high-road and the market-place Hermes was perhaps above all else the patron of commerce and of the fat purse . . . As conductor of the dead to their subterranean abode, his emblem would seem more appropriate on a hearse than on a physician's car.

He was a king of robbers and "to crown his character he was a murderer."

On the other hand Asklepios, the divine healer, was always depicted with a knotted staff with but *one* serpent coiled about it, at his side, or being fed by his daughter Hygeia. Tyson quotes the opinion of Sir James Frazer that:

> It is tolerably certain that originally Aesculapius was neither more nor less than a serpent, which at a later time was transformed into an anthropomorphic god, with a serpent symbol . . . The ancients explained the connection of the serpent with Aesculapius by saying that it is the natural symbol of the healing art, since it periodically renews itself by sloughing off its old skin.

Dr. Tyson has collected a number of early instances of the erroneous use of the Caduceus as a medical symbol. Johann Froben, the Swiss printer of medical books, used as his device a two-serpented wand, surmounted by doves instead of wings, with the motto: "Be ye wise as serpents, and harmless as doves," but this may have been merely a punning device without reference to either Hermes or Aesculapius. Sir William Butts, the famous physician to King Henry VIII, who figures in Shakespeare's play of that name, used the wand with two serpents, and Dr. Caius, the founder of Gonville and Caius College, Cambridge, presented to that institution a Caduceus. In 1844 it figured on the title pages of the London medical book publisher Churchill, and Dr. Tyson thinks this is the last instance of the use of the Caduceus as a medical symbol in England. Both the Royal Army Medical Corps and the French Medical Military Service use the correct Aesculapian emblem. In 1856 "the two snakes once more re-appear, this time on the chevrons of hospital stewards of the U. S. Army; later on the seal of the U. S. Public Health Service, and in 1902 on the uniforms of the U. S. Army medical officers." Probably from such official governmental action the error has been disseminated widely throughout the United States. In the course of six months Dr. Tyson asked thirty-one physicians as to the emblem of Aesculapius and in twenty-seven instances was told that it was a wand with two snakes.

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[1] *Scientific Monthly*, 34:492–498, June, 1932.

Should the *advocatus diaboli* express doubt as to the correctness of the answer, he will perhaps be confronted with the sigillum of the U. S. Public Health Service, the insignia of the U. S. Army Medical Corps, the seals of not a few county medical societies, adornments on many buildings consecrated to the medical profession, such as the splendid "Medical Chambers" recently completed at 140 East 54th St., New York; on hospitals (including that of the newest *Asclepieion* at New Haven, the University Health Department Building), etc., all of which exhibit the two snakes around the wand or forked rod.

NOTICE

THE Royal Academy of Science of Amsterdam has decided to issue a critical edition of the collected papers of Anthony van Leeuwenhoeck. Anybody who is able to give information about manuscripts of Leeuwenhoeck or about other documents or objects relating to this great naturalist is earnestly requested to communicate with the chief-editor, Professor E. C. van Leersum (Vondelstraat 28, Amsterdam-West, Holland).

BOOK REVIEWS

Man and Medicine, an Introduction to Medical Knowledge. By Dr. Henry E. Sigerist, Prof. at Univ. Leipzig. Introduction by Dr. William H. Welch, Prof. of the Hist. of Med., Johns Hopkins Univ. Trans. by Margaret Galt Boise. N. Y., W. W. Norton, Inc. 1932.

This book is a very appropriate debut for the author as successor to Dr. Welch in the chair of Medical History at The Johns Hopkins University. Its author has been lecturing throughout this country during the past year and in that period has not only delighted many audiences with the charm of his addresses, but won the friendly esteem of those interested in his subject throughout the breadth of the land. Dr. Sigerist's book will be of especial value to the student of medicine entering upon the study of his profession, showing him the gradual development of the various branches of his study and enlightening him on their interconnection one with another, but it will also be a great aid to the teacher to present a background of a subject which will make clear to the student its relations with other branches and render its pursuit something more than the mere acquisition of facts. Beginning, as does all medical study, with a consideration of the structure of man (anatomy) and the study of the functions of the various organs and tissues (physiology), Dr. Sigerist shows the way in which such study led to the understanding of the aberrations and changes in formation and structure which occur in disease and this leads to the study of the various conceptions and theories of disease, the causes of disease, and finally the prevention and cure of disease. In other words the student is shown how through many years the study upon which he is entering has developed into the scientific position which it occupies at the present day. The book is not a history of medicine, not even a birdseye view of medical progress. It is a broad philosophic study of the various steps by which the art of medicine has been gradually elevated from the stages of superstition, sorcery and theurgic practice to become a science, based on a correct knowledge of the structure and function of the body's constituent parts, without which a knowledge of pathologic conditions involving them would have been impossible. This is a thought-producing book which should have wide influence. Miss Boise has made a most excellent translation and the book is well indexed.

History of Scottish Medicine. By Dr. J. D. Comrie. Ed. 2. Published for the Wellcome Historical Museum by Baillière, Tindall and Cox, London, 1932, 2 vols.

The first edition of this work was published in 1927 to commemorate the establishment by the British Medical Association at its meeting in Edinburgh in that year of a section for Medical History. It traced the history of medicine in Scotland down to 1860, but at the request of Sir Henry Wellcome Dr. Comrie has expanded it to two handsome volumes, bringing the story down to the present day and vivifying it with an abundance of illustrations and portraits.

Dr. Comrie follows a chronological order in his presentation. Up to the close of the fifteenth century the development of medical science in Scotland followed essentially the lines of its development on the Continent, but in the sixteenth century it acquired certain features of its own and from the beginning of the eighteenth it became associated with the activities of the Scottish universities, Edinburgh, Glasgow, Aberdeen and St. Andrews. Under these circumstances the chronological order necessitates some discontinuity and some repetitions in the story, but these do not materially detract from its interest.

The story begins with an account of the prehistoric and Roman relics found in Scotland, and then proceeds to the period of monkish medicine, with the miraculous cures of St. Columba, St. Cuthbert and other saintly clerics, whose healing powers were perpetuated in many Holy Wells throughout Scotland. Hospitals were early established, for the most part in connection with religious houses, and a list of those in existence at the time of the Reformation is given, though the majority were of a much earlier foundation, probably the result of the edict of Pope Innocent III in the thirteenth century, calling for the establishment of hospitals in all episcopal sees. It is pointed out, however, that these hospitals were essentially homes for incurables, lack of transportation facilities preventing their use for acute cases, while the diagnosis of the early stages of chronic diseases was beyond the skill of the clerical physicians of the day.

Several excerpts are given in facsimile and translations from Scottish medical manuscripts dating from the twelfth to the fourteenth centuries, and special attention is drawn to the existence of some thirty Gaelic manuscripts, mostly of the sixteenth century, translations from the Aphorisms of Hippocrates, of the Salernitan Regimen and of Bernard Gordon's "Lilium Medicinae" being represented. It is interesting that these manuscripts were for the most part the possessions of two families, the MacBeths or Beatons and the Conachers, who seem to have been hereditary physicians.

Until the beginning of the sixteenth century there were no limitations to the practice of medicine and surgery in Scotland, anyone who so desired might prescribe or operate and quackery and inefficiency were rampant. James IV (1473–1513) was, however, greatly interested in medicine and apparently even ventured to operate, not always with success; during his reign, in 1505, a Seal of Cause creating a guild of Barbers and Surgeons was granted by the Town Council of Edinburgh and was confirmed by the king in the following year. This charter conferred upon the guild the right of granting licenses to practice surgery in Edinburgh and the surrounding district and that the "prentissis and servandis" of members of the guild might be properly instructed in the art the guild was granted "anis in the yeir ane condampnit man efter he be deid to make antomell of." It may be noted that the charter of Henry VIII creating the Royal College of Surgeons of London is dated 1540.

Standing ninth or tenth in seniority at its formation, the guild quickly rose in importance and in 1582, under the guidance of Gilbert Primrose, it had become the chief of all the city guilds. The apothecaries were for a time included in it, but when the College of Physicians was established in 1681 they were transferred to the jurisdiction of that body. The union of the barbers with the surgeons proved no more satisfactory than it was in Paris, but persisted until 1718, when wig-making became more lucrative than blood-letting and minor surgery. After separating from the surgeons the guild of barbers continued as an independent organization with gradually diminishing membership until it became extinct in 1892. The present title of the guild of surgeons, the Royal College of Surgeons of the City of Edinburgh, was conferred on it in 1778, when it was granted a new charter.

The Town's College, the infant University of Edinburgh, was established in 1502, but for many years it limited its instruction to arts subjects, medical education being cared for by the Royal Colleges. A certain amount of medical information was, however, regarded as part of a liberal education and in 1685 the Town Council appointed Sir Robert Sibbald professor of physick in its College with James Halket and Archibald Pitcairne as associates, although there is no record that these gentlemen actually conducted courses in the University. A little later the Town Council appointed Robert Eliot professor of anatomy, the first of that title in Great Britain, but while the Council paid his annual stipend of fifteen pounds the instruction was given in the hall of the College of Surgeons. Eliot was succeeded by Adam Drummond and James McGill and on their resignation in 1720 Alexander Monro *primus* was appointed to the chair, lecturing also to some extent in medicine. A professorship of physic and chemistry had been established in 1713 with James Crawford as its first occupant and with the appointment of Joseph Gibson to a professorship of midwifery in 1726 the Town College felt itself in a position to offer a complete course of medical instruction.

The first degree in medicine granted by the Town College was in 1705, but the early degrees were granted only to those approved by the Royal Colleges. Later the examinations for the degree were taken over by the University and this led in 1842 to a demand for recognition by the University of attendance upon the courses of non-academic teachers, a demand that was favored by the Town Council but strenuously opposed by the Senatus of the University and by it carried to the law courts and finally to the House of Lords. The decision was against the Senatus and in 1855 recognition was given to extramural instruction, a recognition that was confirmed and extended by the Universities (Scottish) Act of 1858.

Such is a summary of the development of the system of extramural instruction in Edinburgh, compiled from the more detailed account given by Dr. Comrie. An advantage of the system is a large number of eminent teachers, allowing the student greater choice, more personal contact with his instructor and better opportunities for clinical instruction. Furthermore, instruction was given extramurally in the specialties before they were recognized in the University. Thus an extramural course in ophthalmology was given as early as 1838, but the subject was not recognized in the University until 1883, when Argyll Robertson was appointed University professor after twenty years of teaching in the extramural school. So too it was with pediatrics and psychiatry. From the time of the return of Archibald Pitcairne from Leyden in 1693 there had been able teachers in the University chairs, such as William Cullen, Robert Whytt, James Gregory and Grainger Stewart in medicine, Syme and Lister in surgery, James Y. Simpson in obstetrics, Goodsir and Wm. Turner in anatomy, Allen Thomson and Hughes Bennett in physiology, Joseph Black in chemistry and P. G. Tait in physics, to mention only some of those teaching before 1870. But during the same period there were teaching extramurally Andrew Duncan, the founder of the Harveian and Royal Medical Societies, and Sir Wm. Gairdner in medicine, Grainger Stewart in pediatrics, Liston, Lizars, Syme and Lister in surgery, John and Charles Bell, Robert Knox, Wm. Sharpey and John Struthers in anatomy and many of those appointed to University chairs had won their spurs in the extramural College. So too in the later years of the nineteenth century among the extramural teachers were Byrom Bramwell in medicine, Batty Tuke in psychiatry, Caird in surgery, Berry Hart in obstetrics, Symington, Ryland Whitaker and Berry in anatomy, Gamgee, Pettigrew, McKendrick and Noel Paton in physiology, and H. A. Nicholson and J. Arthur Thomson in Natural history.

The story of medical education in Glasgow is very similar to that of Edinburgh, but in Aberdeen and St. Andrews circumstances led to a development altogether under university control. At

Aberdeen King's and Marischal Colleges both taught medicine and great was their rivalry. The formation of a Students' Medical Society brought them together in 1818, but they separated again in 1839, their final union to form the University of Aberdeen taking place in 1860. The University of St. Andrews was founded in 1411 and in the sixteenth century consisted of three colleges, one of which, shortly after the Reformation, specialized in theology, while the other two were incorporated in 1747 as the United Colleges of St. Salvator and St. Leonard. Medicine seems to have been taught from an early date, but merely as a part of the arts course, although the University exercised its charter right to grant a medical degree, occasionally *honoris causâ*, frequently *ad eundem gradum* and sometimes *in absentiâ*, for a consideration. The University College, Dundee, was founded in 1881, but by the Universities (Scottish) Act of 1889 it was affiliated with the University of St. Andrews, an affiliation that was consummated in 1894, when it was arranged that the first two years of the medical course might be taken either at St. Andrews or Dundee, but the clinical years only at Dundee.

The development of medical education in Scotland has been emphasized, but it forms but a part of the interest of Dr. Comrie's book. All the worthies who taught in the Scottish medical schools receive mention with some account of their careers, often illuminated by an anecdote and, in the majority of cases, by a portrait. Further a chapter is devoted to the activities of Scottish graduates other than the teachers in the Universities and a remarkable record of achievement is revealed associated with such names as Mungo Park and David Livingstone, Matthew Baillie, Abraham Colles, Richard Bright, Thomas Addison, Wm. Stokes and Sir Andrew Clark, Burdon Sanderson and Lauder Brunton, Charles Darwin, Sir Henry Holland, Samuel Smiles and Conan Doyle, Joseph Fayrer, Andrew Balfour, Spencer Cobbold and Patrick Manson.

Nor is it only the educational and biographical sides of Scottish medicine that Dr. Comrie considers. There is a chapter on the occurrence and treatment of leprosy, syphilis and plague, with the regulations for their control, especially interesting being the early campaign of Aberdeen against rats and mice and the occurrence in southern Scotland in the eighteenth century of an infectious disease known as "sibbens" and supposed to be identical with yaws, a malady prevalent in West Africa. Other chapters deal with the development of the physick gardens in Edinburgh, with the foundation and growth of the Royal infirmaries of Edinburgh and Glasgow, with the establishment of insane asylums in Scotland, with Scottish contributions to military medicine and surgery and with legislative enactments affecting medical education and practice in Scotland. In short, the two volumes cover very thoroughly the whole history of medicine in Scotland and one comes from a perusal of them with a deep sense of gratitude to the author for the care and labor he has expended and with congratulations on his most interesting presentation of his story.

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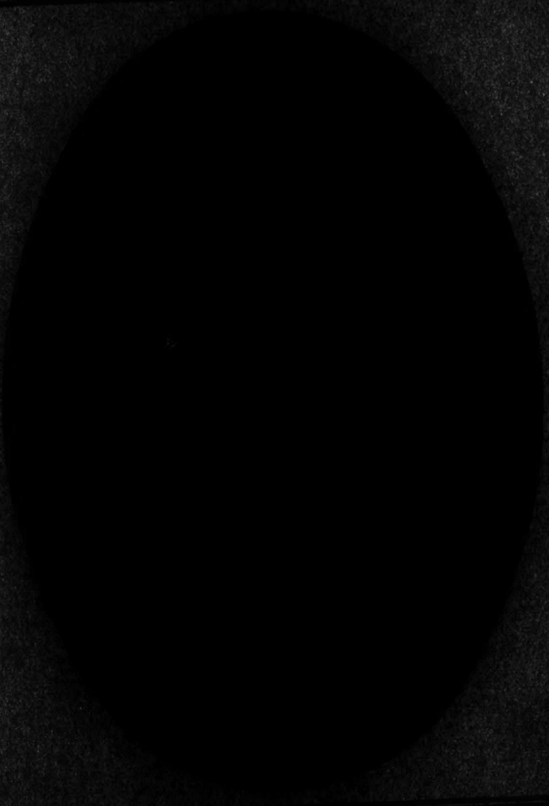

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